UNITED STATES SUICIDE ANALYSIS: 1999-2016

by

Malynn Eleanor Clark

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College.

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Approved by:

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Advisor: Professor Dawn Wilkins

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Reader: Professor Yixin Chen

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Reader: Professor Philip Rhodes

ABSTRACT

Malynn Eleanor Clark: United States Suicide Analysis: 1999-2016

(Under the direction of Dawn Wilkins)

The purpose of this thesis is to create information visualizations surrounding suicide trends from 1999-2016 in the United States. The original data was obtained from the Centers for Disease Control and Prevention's Compressed Mortality Database. This database permits users to download several fields of information regarding deaths for the years given. Using this information, many graphs below show trends and patterns for suicide. One notable trend includes the higher proportion of male to female suicides for all categories explored including: age group, race, and metro/nonmetro status. The goal is to bring awareness and understanding surrounding the suicide epidemic in the United States.

Table of Contents:

List of Figures & Tables

Abbreviations

AI/AN: American Indian and Alaskan Native

CBSA: Core-Based Statistical Area

CDC: Centerss for Disease Control

CMR: Compressed Mortality, 1999-2016 Request

CSV: Comma-Separated Values

HHS: Department of Heath and Human Services

ICD: International Classification of Disease

NCHS: National Center for Health Statistics

Background

A 19th century French novelist once wrote, “there is something noble as well as terrible about suicide” (Balzac, Marriage, Saintsbury 1899). Suicide has been an important area of conversation for centuries, and that conversation continues to grow today. In the US alone, suicide has been the 10th leading cause of death for all ages, since 2008 (Hedegaard, Curtin, Warner 2018). With suicide rates in the US steadily increasing, it is important that statistical analysis is completed. In this examination, an in-depth study of suicide in the United States from 1999-2016 will be discussed.

For every death in the United States, a death certificate must be completed. Each death certificate must be provided to the National Center for Health Statistics (NCHS) “through the Vital Statistics Cooperation program or Coed by NCHS from copies of the original death certificate provided to NCHS by the State registration office” (Center for Disease Control and Prevention, 2018). The certificate consists of approximately 55 fields (“U.S. Standard Certificate of Death,” 2003). These fields can provide important information when used for descriptive statistics. The Compressed Mortality, 1999-2016 Request Form (CMR Form) allows individuals to download comma separated values (csv) files containing the statistics provided by death certificates. Since this study explored

statistics regarding suicide, the CDC CMR Form was used to download data for deaths relating to suicide.

In order to filter through the death certificates pertaining to suicide, only death certificates with the “Injury Intent” of “suicide” were included in this study. More specifically, this field in the CMR Form is provided by the “MANNER OF DEATH” section in each death certificate (Center for Disease Control and Prevention, 2004). Utilizing this method to narrow down the information, the statistics regarding each of these items was further divided by the following descriptors: Census Region, Census Division, Department of Heath and Human Services (HHS) Region, State, County, 2013 Core-Based Statistical Area (CBSA), 2005 CBSA, 2013 Metro/Nonmetro, 2005 Metro/Nonmetro, 2013 Urbanization, 2006 Urbanization, Age Group, Infant Age Groups, Year, Gender, Race, Hispanic Origin, International Classification of Disease (ICD) Chapter, ICD Sub-Chapter, Cause of Death, ICD 113 Groups, Injury Intent, Injury Mechanism & Other Leading Causes (CDC Wonder, n.d.). This particular examination will involve the following fields: Year, Gender, Age Group, ICD Chapter/Cause of Death, 2013 Metro/Nonmetro, and Race. The ICD Chapter/Cause of Death section corresponds to a code that specifies how the individual died, which will be later discussed in Chapter 1 Part 4. The 2013 Metro/Nonmetro categorization specifies whether the individual’s permanent place of residence is considered metropolitan or non-metropolitan (“U.S. Standard Certificate of Death,” 2003). Additional details regarding the 2013 Metro/Nonmetro field will be addressed in Chapter 1 Part 5.

The first chapter will be divided into sections where a more in-depth description of each field and criteria for filling out that field will be provided. The last chapter will focus on combining the different descriptors for a more full analysis of the data.

One key component that should be mentioned before diving deeper into the data is that these statistics are considered to be a minimum number of successful suicides. In the event that suicide cannot be determined definitively, the death can be ruled as an “accident” or as “could not be determined.”

The purpose of this examination is to provide visualization, in hopes of identifying trends and providing useful graphs. These tools can then be used by professionals in the area of psychology to further help individuals affected by suicide and suicidal thoughts.

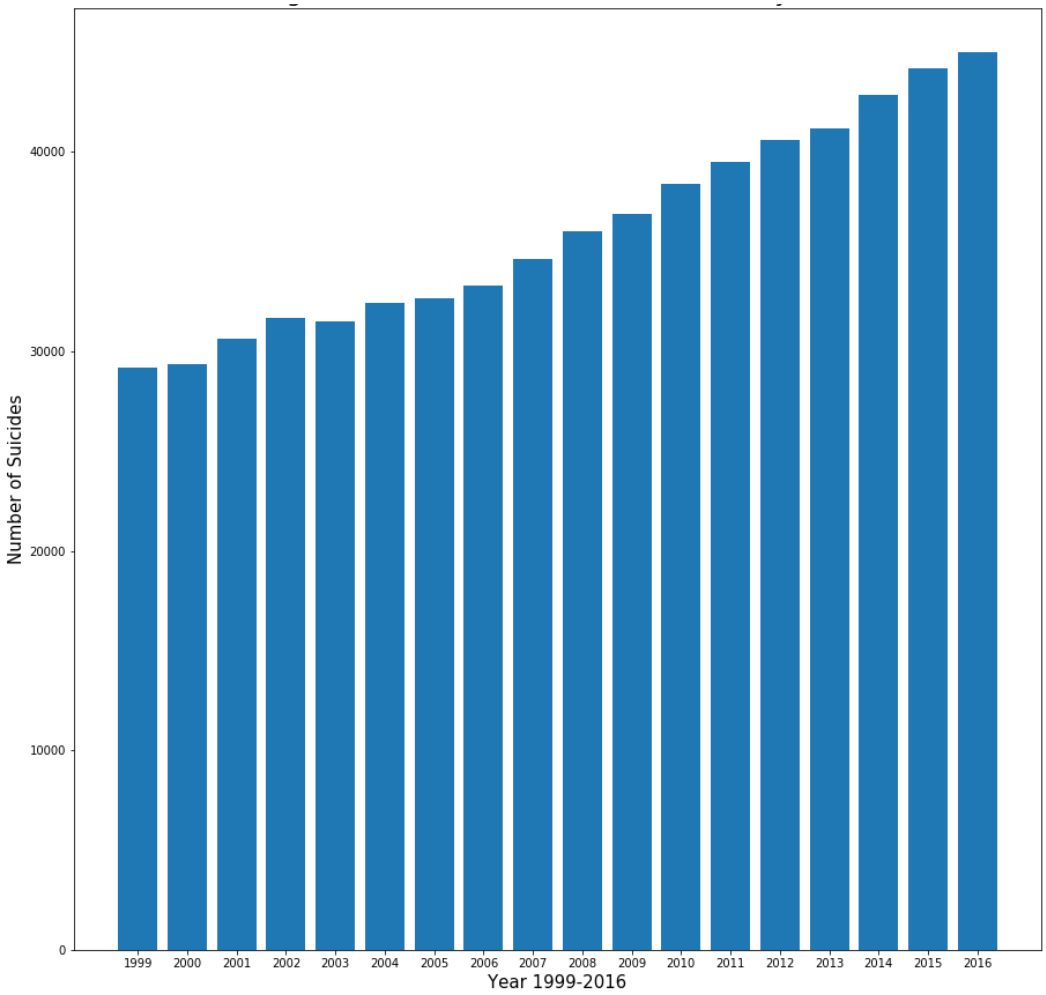
Chapter 1: Field Breakdown

This chapter will explore the data in each specified field with the aid of information visualization. Each section will consist of the process of downloading a Comma-Separated Values (csv) file from the database, editing the file using a shell script, and creating a python script to parse and graph the data as described in Appendix A Part 1. Each section will focus on the data downloaded from the CDC Wonder Database with the fields specified in the section header and the year. Every dataset has been checked to ensure the total number of suicides remains consistent for each year.

Part 1: Overall By Year

The first visual representation is a bar graph that shows the total number of fatal suicide attempts by each year. From Figure 1.1.1, a steady increase in the total number of suicides can be observed, but when considering the added factors of population growth, another representation is necessary to gain a clearer picture of the information.

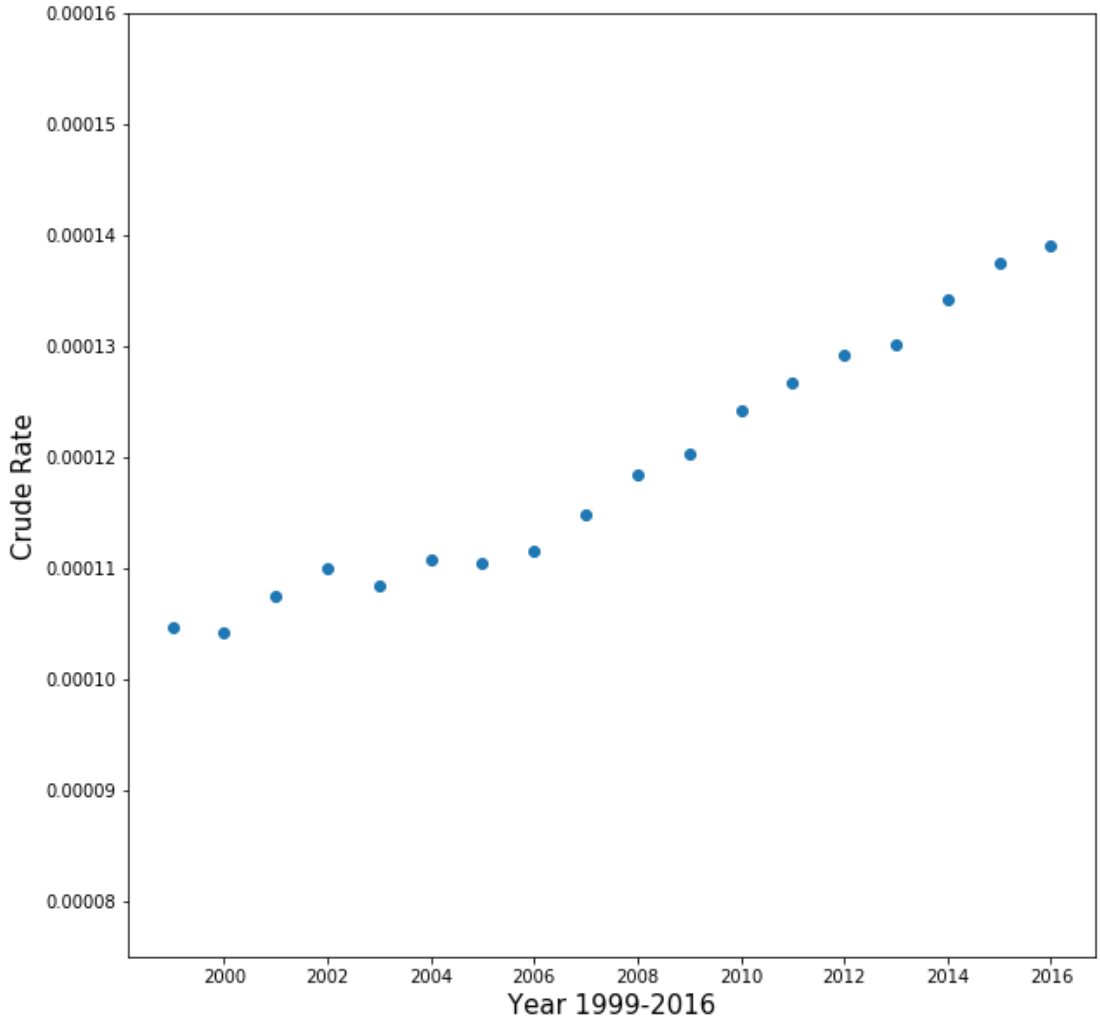
Figure 1.1.1 Number of Suicides 1999-2016 By Year



A way to remove this bias is to consider the rate based on the population for each year and is displayed in Figure 1.1.2. This rate was determined by taking the total number of suicides each year and dividing them by the population statistics provided by the CDC. This statistic provides the fractional value for the number of individuals that have committed suicide. Using this visual representation, it can also be concluded that the overall rate as a percentage of the population has also steadily increased since 1999. Additionally,

in 2003 and 2004, there was a spike in this percentage outside of the normal rate of increase.

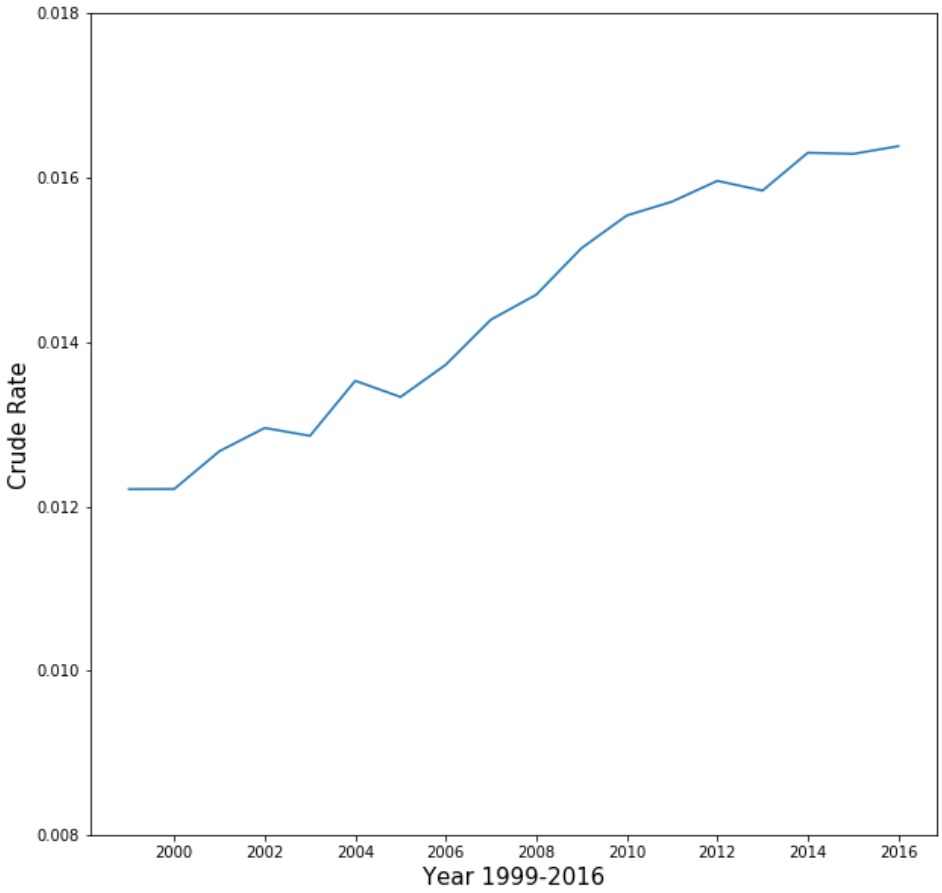
Figure 1.1.2 Rate of Suicides by Population 1999-2016 by Year



Another perspective of this information could be provided by determining what fractional value these suicides contributed to the total number of deaths and is shown in Figure 1.1.3. This numerical representation also has a steadily increasing rate. The year with the highest percentage of deaths due to suicide was 2016, accounting for 1.6385% of all deaths for the year. Considering

the number one leading cause of death is heart disease, contributing 23.59% of deaths, it is no surprise that suicide has been ranked the tenth “leading cause of death for all ages” since 2008 (Hedegaard, Curtin, Warner 2018).

Figure 1.1.3 Rate of Suicide by Deaths 1999-2016 by Year

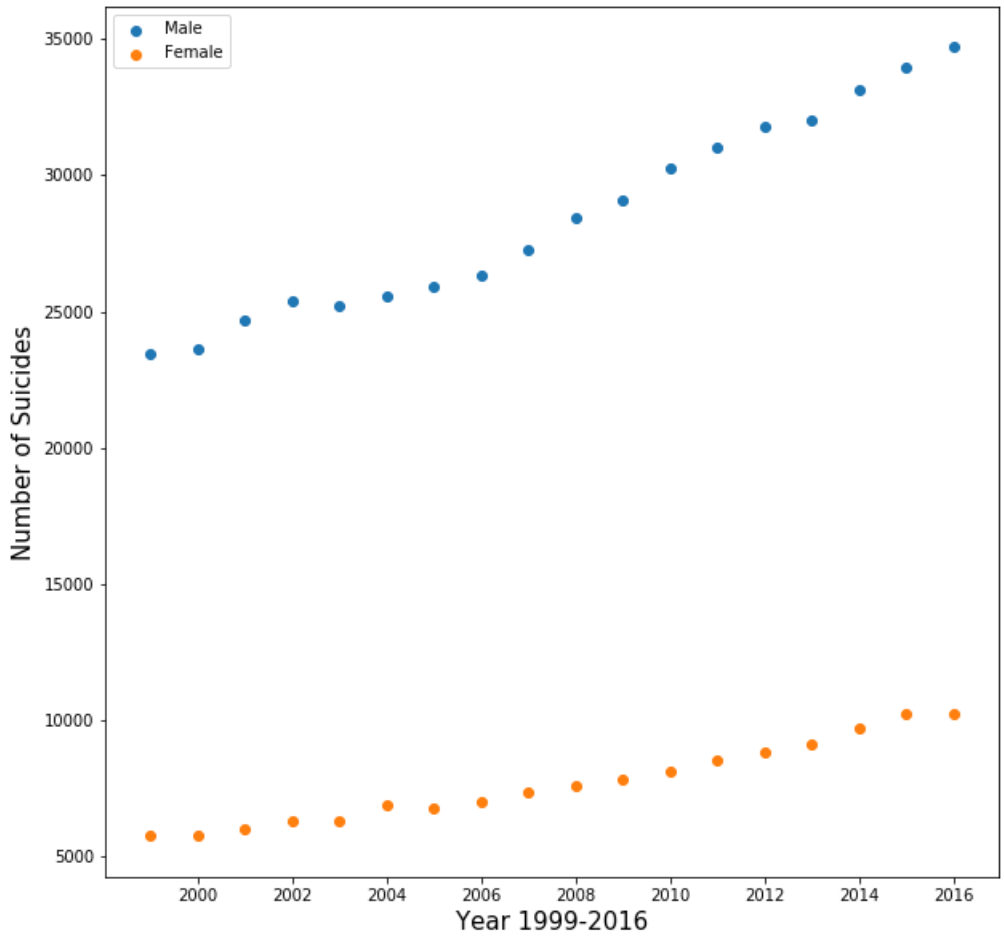


Overall, suicide is continuing not only to take a higher number of lives each year, but is also affecting a higher percentage of the population, while contributing a higher percentage of the overall number of deaths.

Part 2: Gender

From the data, large difference between the number of male and female suicides can be observed. During this time period a total of 649,840 suicides were committed with 511,947 or 78.8% of those being male. On the other hand, females accounted for 137,896 or 21.2% of the successful suicides. Both genders have had a steady increase in the overall number of suicides.

Figure 1.2.1 Number of Suicides 1999-2016 by Year and Gender



Similarly to Chapter 1 Part 1, the information can also be represented using rates based on population to gain a better context for the total number. Rather than using the total population that was used in Part 1 for the male

suicides, the total number of males in the United States was used, and for the female suicides, the total number of females in the United States was used. Given a similar number of males and females and the information from Figure 1.2.1, it is unsurprising that males are affected at a higher percentage by suicide than females. Both genders have had a steadily increasing percentage fatalities due to suicide. The rate for males has risen rom .0171% in 1999 to .02183% in 2016, creating a 27.66% increase. The rate for females has risen with an all time low in 2000 of .003998% and an all time high in 2015 of .00629%, creating a 57.3% increase.

Figure 1.2.2 Rate of Suicides by Population 1999-2016 by Year and Gender

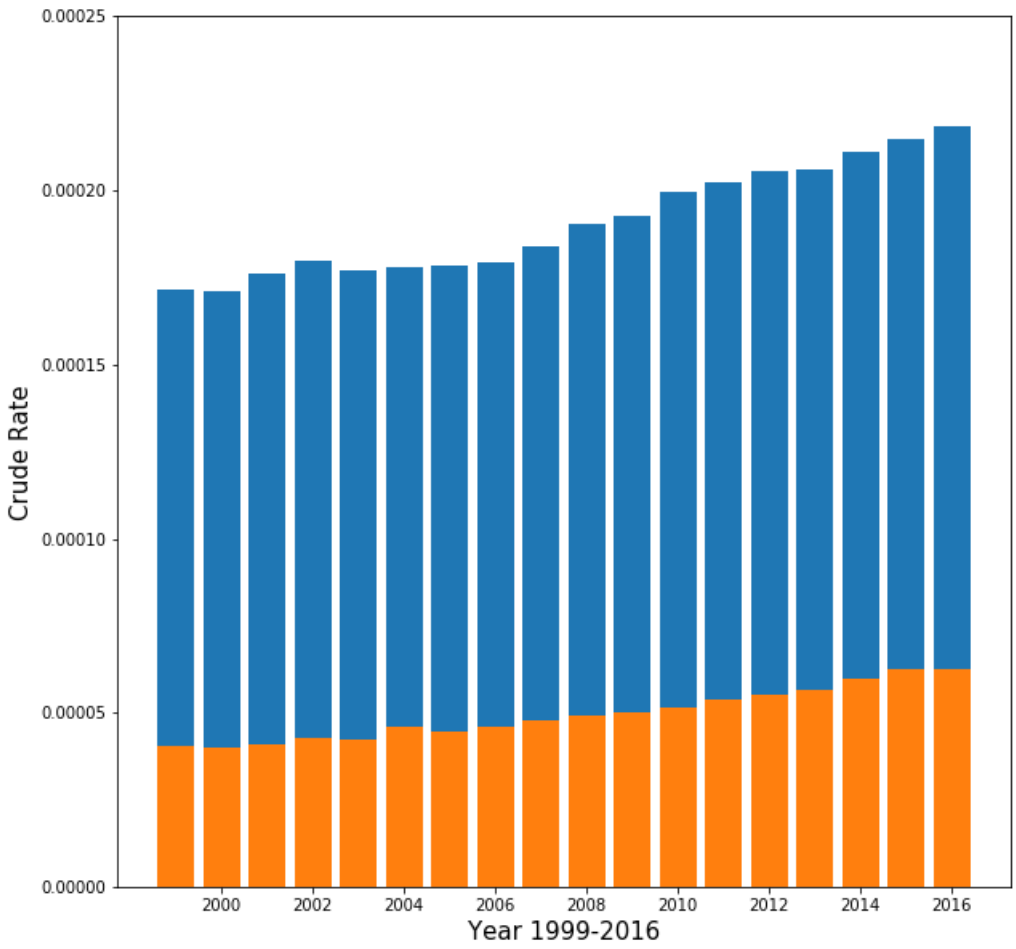
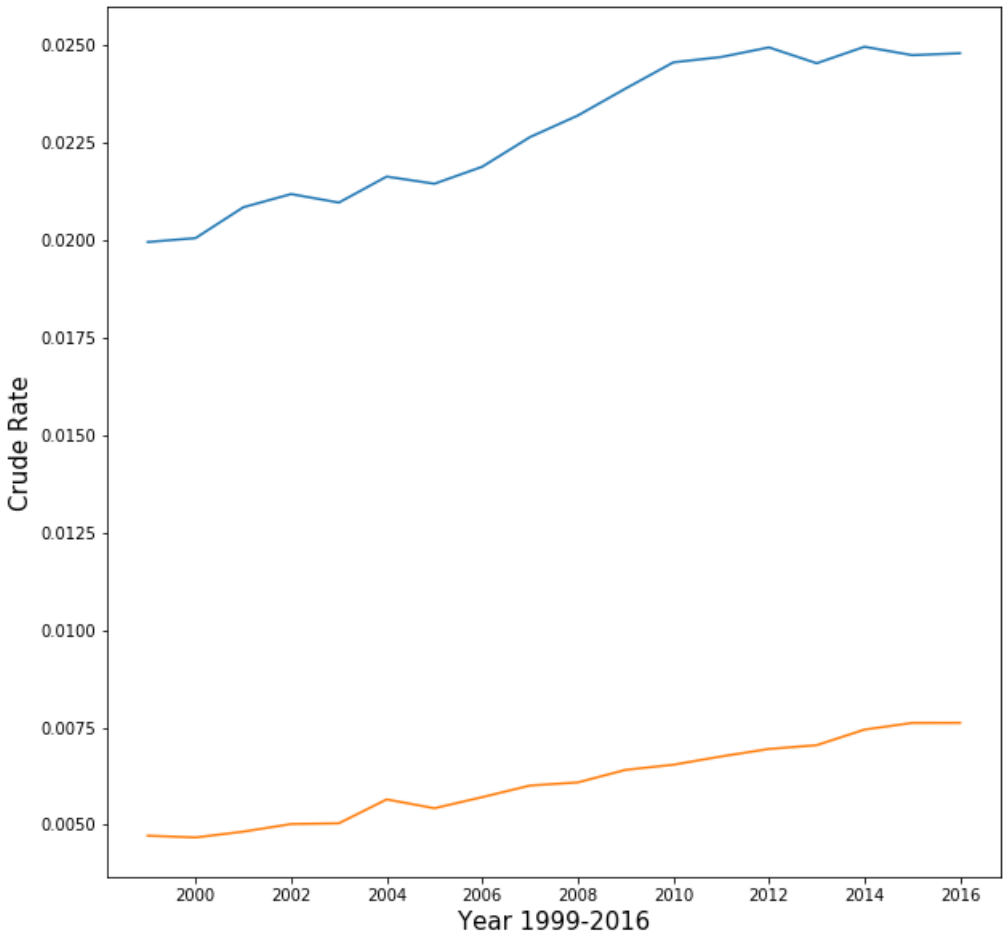


Figure 1.2.3 shows the fractional value of the number of suicides by the number of deaths, for each gender. Even though males have a much higher percentage of suicides contributing to deaths than females, in recent years, the rate for females has been increasing at a much faster rate.

Figure 1.2.3 Rate of Suicide by Deaths 1999-2016 by Year and Gender



Overall the disparity in suicide between men and women is large;

however, if recent trends continue, the gap between the percentage of suicides, in respect to death, could close. One study notes that the disparity between suicide and gender is not a reflection on suicide attempts or mental health. In this study, it was found that females have a higher rate of suicide attempts and mental heath issues; males simply have a higher percentage of successful suicides (Choo, C. C., Harris, K. M., Ho, R. C., 2019).

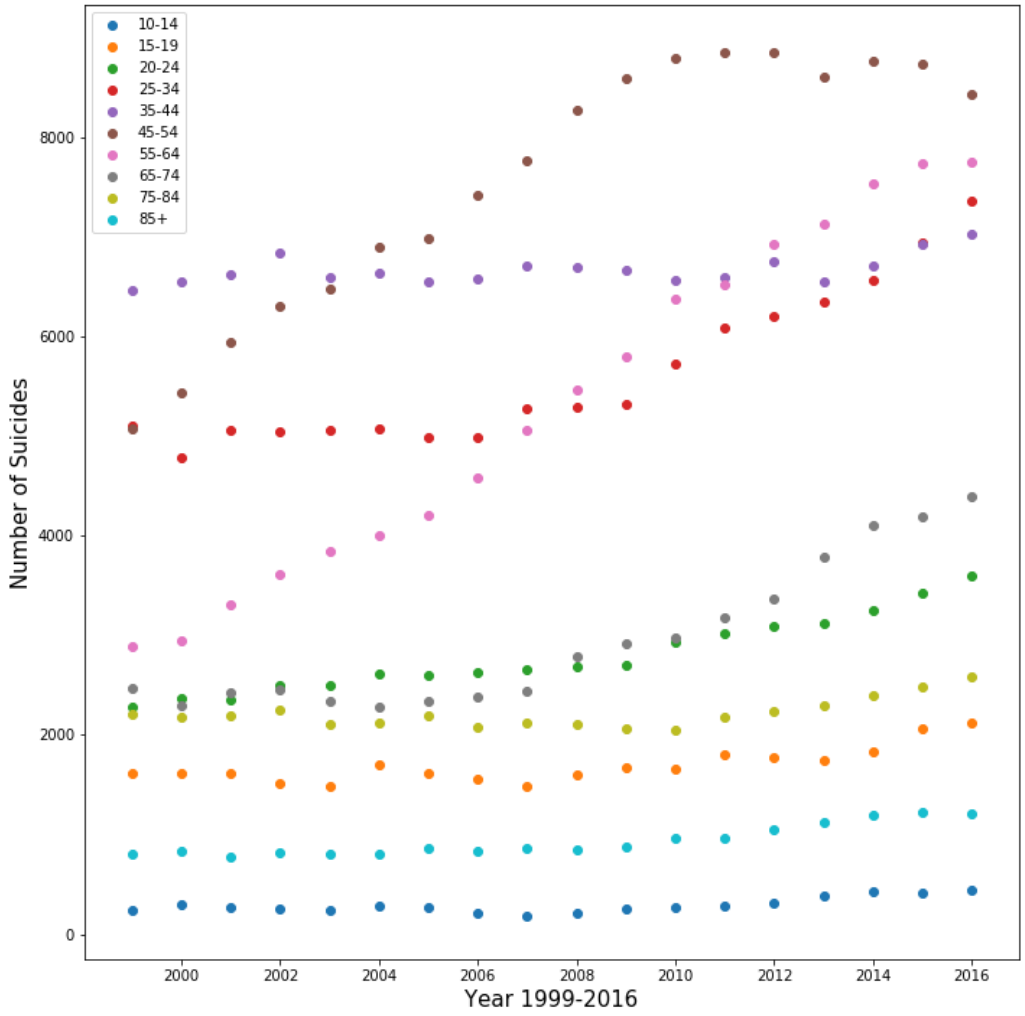
Part 3: Age Group

Two age groups were excluded from this analysis: “5-9 years old” and “not stated.” These two groups were not included due to the number of reported cases per year being below nine, and using these statistics would be in violation of the CDC restrictions on the data for being insufficient. When completing analysis to ensure that the number from each section matched, the values from the excluded groups were included, and the overall total number of suicides remained the same.

Figure 1.3.1 consists of the total number of suicides for each age group by each year. From the information, the age groups of 10-14, 85+, 15-19, and 75-84 had the least number of suicides during 1999-2016, with the totals remaining relatively consistent. The 35-44 age group had the highest number of suicides from 1999-2003. After 2003, the totals for that age group began fluctuating immensely. All the other age groups have had steady increases in the number of suicides in each year, with the age group of 45-54 contributing the highest number of suicides since 2004. Another notable trend happened with the 55-64

age group, which increased at a much higher rate than any of the other age groups.

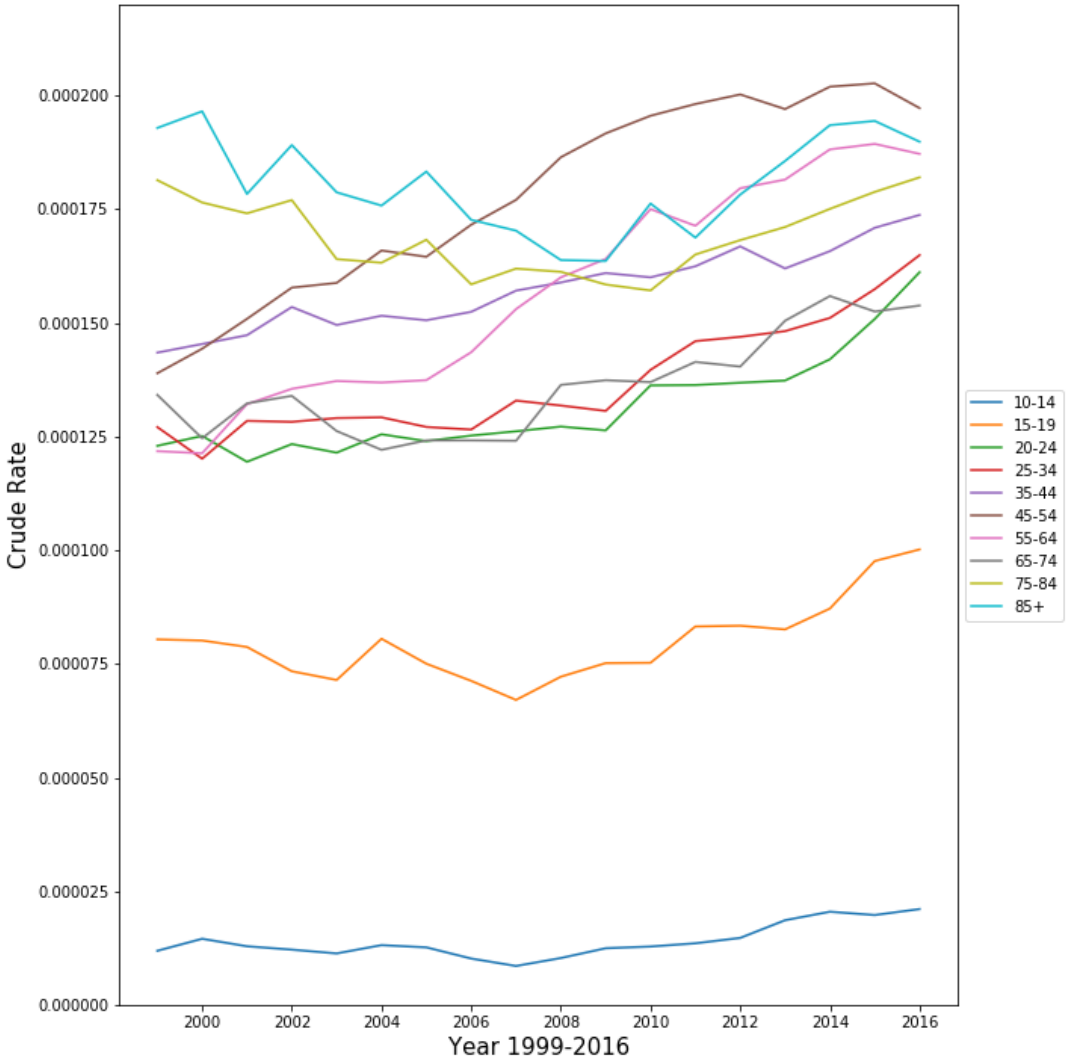
Figure 1.3.1 Number of Suicides 1999-2016 by Year and Age Group



Similar to the other parts of this chapter, the rate based on the age group populations was also considered. In the following graph, each number of suicides was divided by the total population of the age group at that time to determine the rate graphed below. This graph provides a better view of how suicide effects each age group, with most of the age groups having fluctuating rates among the

same range. The two exceptions to these clusters are the age groups of 10-14 and 15-19. The age group of 10-14 has remained at relatively the same low rate over the time period. The age group of 15-19 has a much lower percentage of suicides, but experienced an increasing rate over the time period. Additionally, the age group of 45-54 has the fastest increasing rate of individuals committing suicide for the total population. Professor of sociology at Rutgers, Julie Phillips, believes social changes are at fault for the increasing rate of suicides in middle aged individuals (Tavernise, 2016). She states that marriage rates have been declining, divorce rates have risen, and unfulfilled expectations of social and economic well-being from the “baby-boom generation”, have all lead individuals to feel further social isolation and therefore turn to “self destructive means” (Tavernise, 2016).

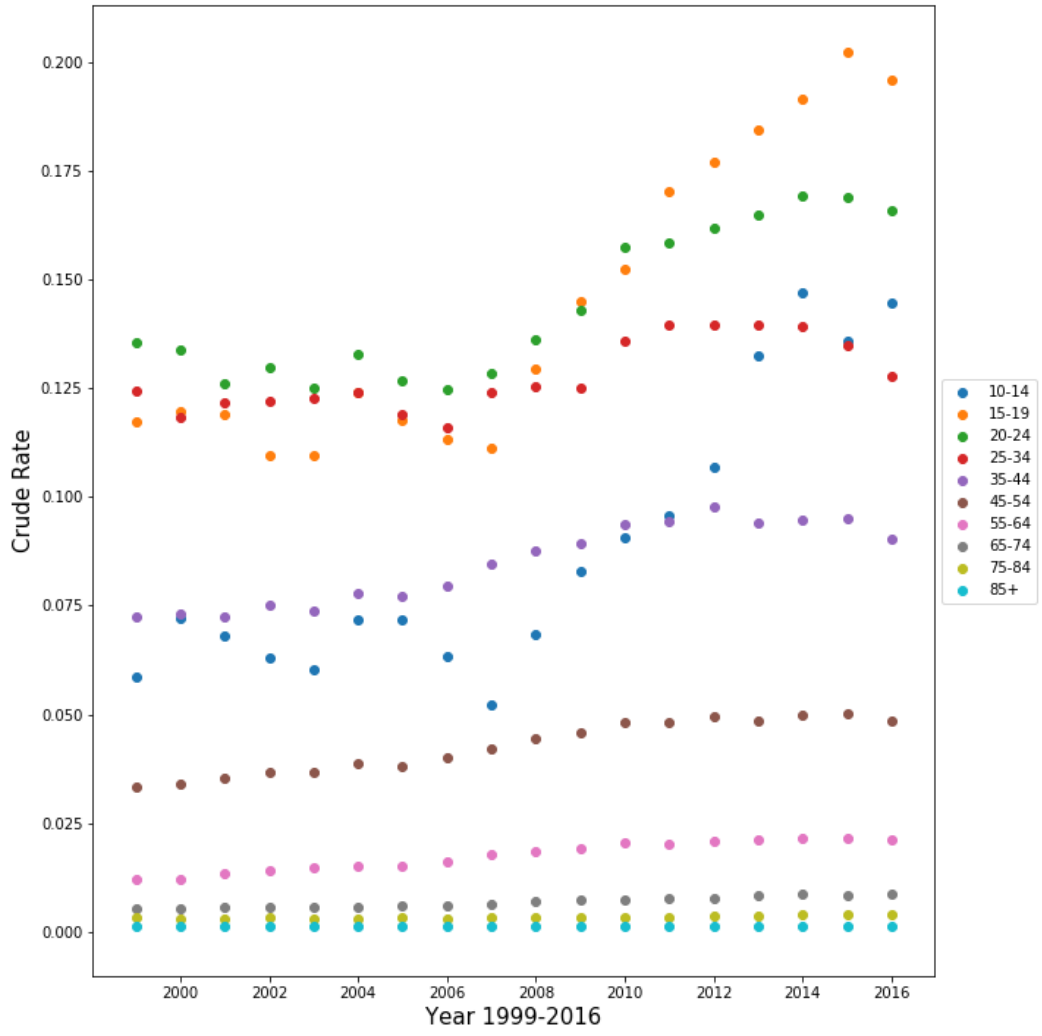
Figure 1.3.2 Rate of Suicides by Population 1999-2016 by Year and Age Group



In Figure 1.3.3, the proportion of deaths by age group that have been suicides is represented. This representation gives us a better insight to the overall affect suicide has on these age groups. Although in previous sections, age groups 10-14 and 15-19 have had the smallest number of suicides and the lowest rate, the percentage of deaths attributed to suicide is higher than many of the other age groups. The age group 15-19, has had the highest percentage of

deaths attributed to suicide since 2011, with a time period high in 2015 of 20.23%. Additionally, the highest rate from 1999-2011 and the second highest rate since 2012 has been the age group of 20-24. Another noticeable trend occurs following 2008, when all the age groups have an increase in their suicide rate. Two researchers, Aaron Reeves, at the University of Cambridge, and Sanjay Basu, at Stanford University, related the spike to the 2008 recession, stating that it had lasting impacts on individuals' mental health (Carey, 2012).

Figure 1.3.3 Rate of Suicides by Deaths 1999-2016 by Year and Age Group



Overall, the first two representations cause the most concern for middle-aged individuals who contribute the highest number and population proportion of suicide. Figure 1.3.3 provides increasing concern for the younger age groups, whose groups have the highest percentage of deaths due to suicide.

Part 4: Cause of Death

Additional manual cleaning of the csv file was required for the commas located in the “cause of death” field. For this specific examination, some values were excluded, whose totals were under 9, in order to follow the CDC rules on the use of the data.

For each death certificate, a code that describes the cause of death must be included. Below, Table 1.4.1 is a table of the codes, pertaining to suicide, and the description of each code.

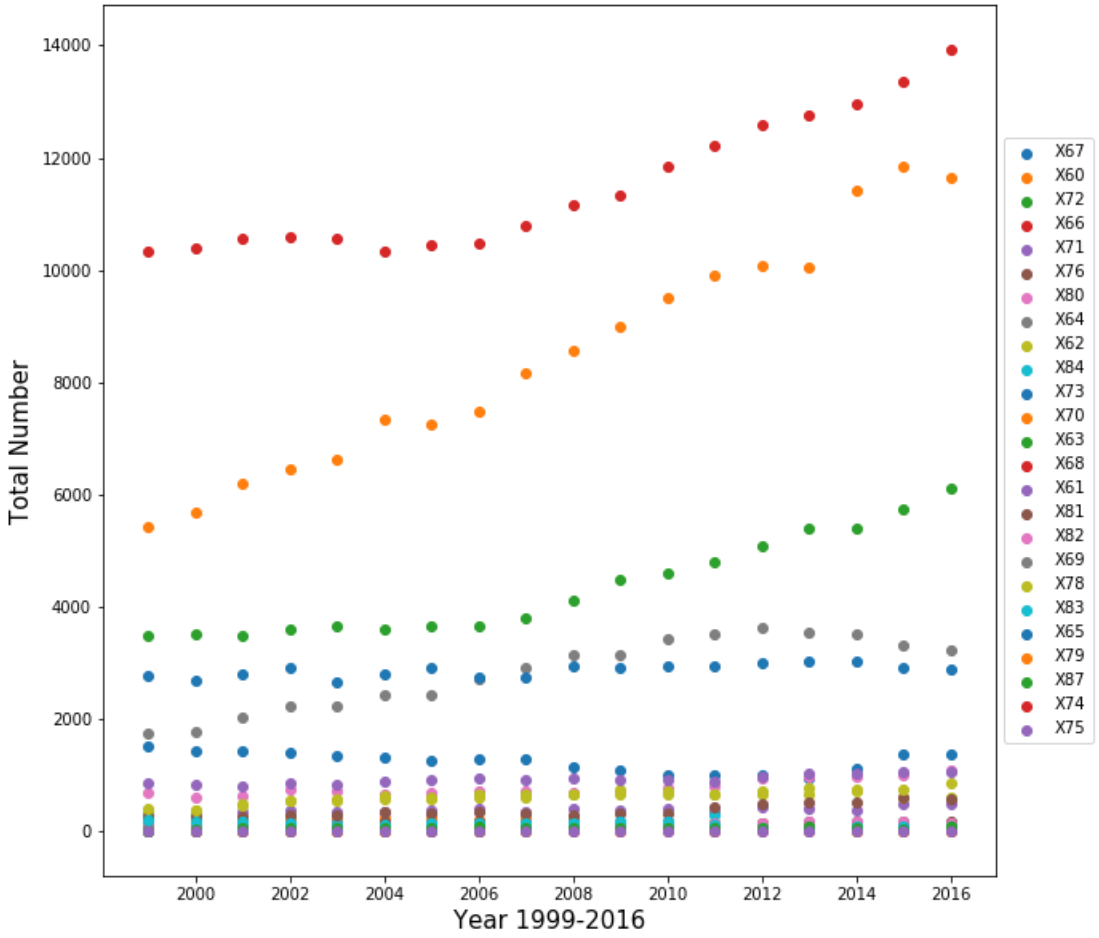
Table 1.4.1 Death Codes

Codes	Definition
X60	Intentional self-poisoning by and exposure to nonopioid analgesics antipyretics and antirheumatics
X67	Intentional self-poisoning by and exposure to other gases and vapours
X72	Intentional self-harm by handgun discharge
X66	Intentional self-poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours
X71	Intentional self-harm by drowning and submersion
X76	Intentional self-harm by smoke fire and flames
X80	Intentional self-harm by jumping from a high place
X64	Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances
X62	Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens] not elsewhere classified

X84	Intentional self-harm by unspecified means
X73	Intentional self-harm by rifle shotgun and larger firearm discharge
X70	Intentional self-harm by hanging strangulation and suffocation
X63	Intentional self-poisoning by and exposure to other drugs acting on the autonomic nervous system
X68	Intentional self-poisoning by and exposure to pesticides
X61	Intentional self-poisoning by and exposure to antiepileptic sedative-hypnotic antiparkinsonism and psychotropic drugs not elsewhere classified
X81	Intentional self-harm by jumping or lying before moving object
U03.0	Terrorism involving explosions and fragments
X82	Intentional self-harm by crashing of motor vehicle
X69	Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances
X78	Intentional self-harm by sharp object
X77	Intentional self-harm by steam hot vapours and hot objects
X83	Intentional self-harm by other specified means
X65	Intentional self-poisoning by and exposure to alcohol
X79	Intentional self-harm by blunt object
Y87.0	Sequelae of intentional self-harm
X74	Intentional self-harm by other and unspecified firearm discharge
X75	Intentional self-harm by explosive material

Below, Figure 1.4.1 shows the total number of suicides successfully completed for each death code per year. Due to the sheer number of death codes presented, the main item that can be gleaned from the information is the top three contributors, in order, that have an increasing number of suicides each year: x74 (intentional self-harm by other unspecified firearm discharge), x70 (intentional self-harm by hanging strangulation and suffocation), and x72 (intentional self-harm by hand-gun discharge).

Figure 1.4.1 Number of Suicides 1999-2016 by Year and Death Code



Given the number of codes and the difficulty to visualize the totals, Table 1.4.2 combines similar codes, in order to better understand and visualize the data.

Table 1.4.2 Combined Death Codes

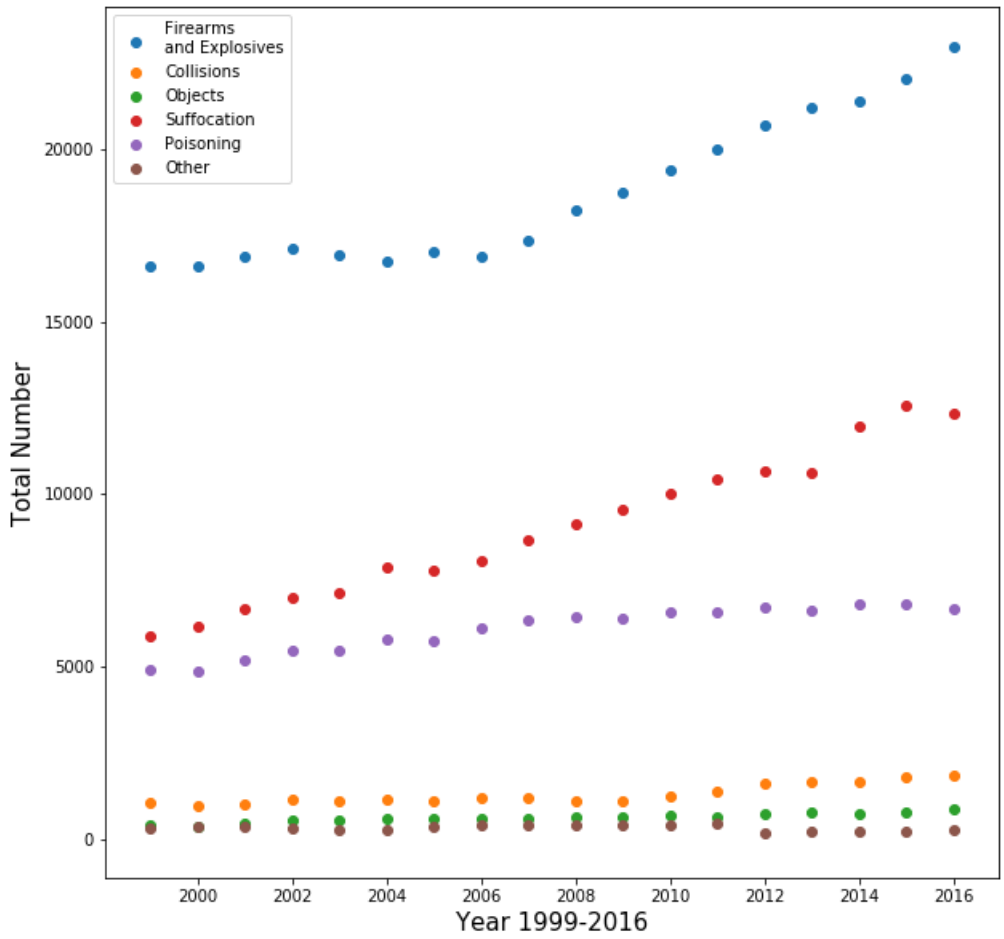
Grouping	Death Codes
Firearms and Explosives	X72 (Intentional self-harm by handgun discharge), X73 (Intentional self-harm by rifle shotgun and larger firearm discharge), X74 (Intentional self-harm by other and unspecified firearm discharge), X75(Intentional self-harm by explosive material), U03.0(Terrorism involving explosions and fragments)

Collisions	X80(Intentional self-harm by jumping from a high place), X81(Intentional self-harm by jumping or lying before moving object), X82(Intentional self-harm by crashing of motor vehicle)
Objects	X78(Intentional self-harm by sharp object), X77(Intentional self-harm by steam hot vapours and hot objects), X79(Intentional self-harm by blunt object)
Suffocation	X71(Intentional self-harm by drowning and submersion), X76(Intentional self-harm by smoke fire and flames), X70(Intentional self-harm by hanging strangulation and suffocation)
Poisoning	X60(Intentional self-poisoning by and exposure to nonopioid analgesics antipyretics and antirheumatics), X67(Intentional self-poisoning by and exposure to other gases and vapours), X66(Intentional self-poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours), X64(Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances), X62(Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens] not elsewhere classified), X63(Intentional self-poisoning by and exposure to other drugs acting on the autonomic nervous system), X68(Intentional self-poisoning by and exposure to pesticides), X61(Intentional self-poisoning by and exposure to antiepileptic sedative-hypnotics antiparkinsonism and psychotropic drugs not elsewhere classified), X69(Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances), X65(Intentional self-poisoning by and exposure to alcohol)
Other	X84(Intentional self-harm by unspecified means), X83(Intentional self-harm by other specified means), Y87.0(Sequelae of intentional self-harm)

Using the Table 1.4.2, Figure 1.4.2 was constructed to give a better visualization of the death codes over time. From the information, it can be concluded that firearms and explosives are the most common category of suicide method. Additionally, both suffocation and firearms are sharply increasing, whereas the other descriptors are either slowly increasing or staying the same. Suicide by firearms and suffocation (i.e. hanging) are the most deadly with over an 80% case fatality (Park, Ahn, Lee & Hong, 2014). According to an article in the International Journal of Health, lethal suicides in the United States are steadily

increasing, and when legislation to curb the increasing number of firearms is instantiated, rather than decreasing overall suicide, more suicides are committed by suffocation (Park, et al., 2014).

Figure 1.4.2 Number of Suicides 1999-2016 by Year and Simplified Death Code Groupings



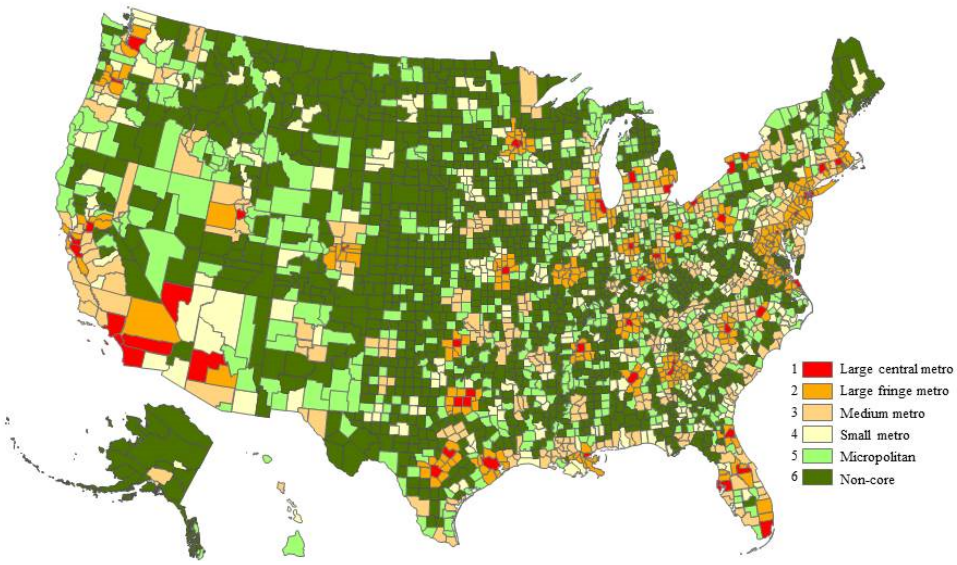
Overall, the codes of suicide associated with firearms and suffocation, the most deadly methods, have the largest number and proportion of suicides comparatively.

Part 5: Metro/Nonmetro

The metro areas contain the urbanization categories of: large central metro, large fringe metro, medium metro, and small metro (Center for Disease Control and Prevention, 2018). The nonmetro areas included are: micropolitan and noncore (Center for Disease Control and Prevention, 2018). The nonmetro counties have a population below 50,000 and are defined as micropolitan statistical areas or smaller (Ingram, Franco, 2014). Each county is categorized and the urbanization level attached to each death certificate corresponds to the county of permanent residence of the individual, not where the suicided occurred.

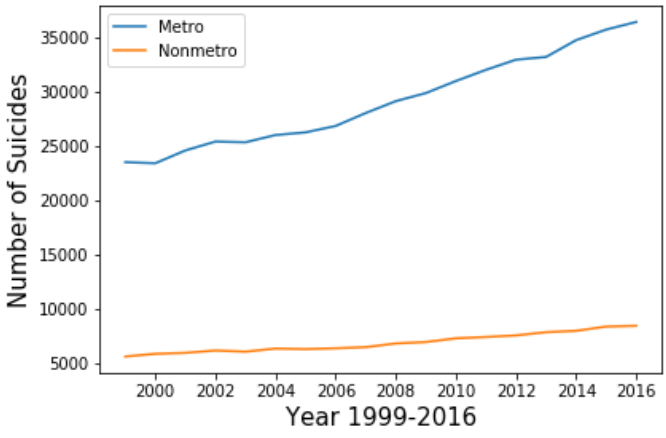
In Figure 1.5.1, a map of the United States is provided with the metro/ nonmetro county classifications, with the nonmetro areas shaded with greens and the metro areas with red, orange, and yellow (National Center for Heath Statistics, 2017). For example, Lafayette County, MS (includes Oxford) is considered nonmetro, where as Hinds County, MS (includes Jackson) is considered metro. For a full list of US counties and their corresponding classifications, please refer to the CDC's Vital and Health Statistics' 2013 NCHS Urban-Rural Classification Scheme for Counties (Ingram, Franco, 2014).

Figure 1.5.1 2013 Metro/Nonmetro County Classification



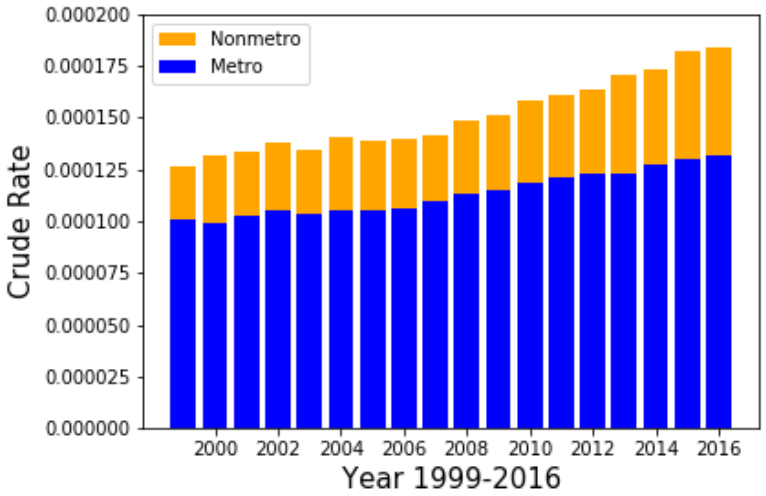
In Figure 1.5.2, the total number of suicides committed each year is divided based on the urbanization category. There is a sharp and continual increase in the number of suicides for metro areas, with comparatively few nonmetro suicides each year. The result of this representation is unsurprising, since there is a larger number of people in urban areas, comparative to more rural areas.

Figure 1.5.2 Number of Suicides 1999-2016 by Year and Metro/ Nonmetro



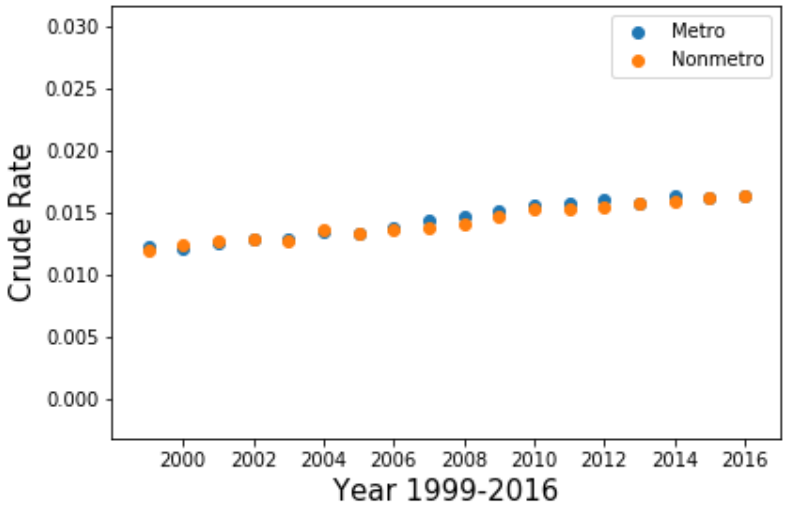
Due to the issue of differing population size, it is necessary to also look at the number of individuals committing suicide compared to the overall population for each category. For Figure 1.5.3, the number of suicides for the given area was divided by the overall population for the classification of that year. In this graph, the nonmetro suicides have a much higher rate than the metro suicides. At its peak in 2016, nonmetro suicides accounted for a total population loss of 0.01837%. In an LA Times article, Healstaff related the increasing rates of suicide in nonmetro areas to the opioid crisis, which first took its roots in rural America (2019). Additionally, for both areas the rate of suicide is consistently increasing.

Figure 1.5.3 Rate of Suicides 1999-2016 by Year and Metro/ Nonmetro



Another representation was also necessary for graphing the total number of suicides by the number of deaths for each area. From this information, it can be concluded that suicides account for almost the same percentage of death for metro and nonmetro areas. This percentage has slightly increased over the last 17 years, while remaining nearly identical for both areas.

Figure 1.5.4 Rate of Suicides as a Percentage of Total Deaths 1999-2016 by Year and Metro/Nonmetro

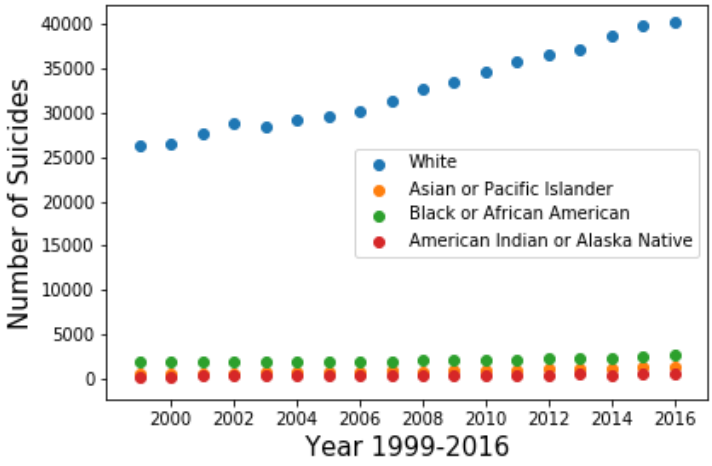


Part 6: Race

The division of races consisted of White, Asian or Pacific Islander, Black or African American, American Indian or Alaska Native, or Not Stated. Due to the low number of suicides classified with a “Not Stated” race, these values were excluded from the representation and discussion below. It is also important to note that those classified as “Hispanic Origin” are not included in the race category, rather, individuals must declare one of the given races above, and hispanic origin is included in an additional field on the death certificate.

In Figure 1.6.1, the “White” race contributes the highest number of suicides. This statistic is unsurprising given that a majority of the US population over these years is White. Additionally, the number of White suicides is steadily increasing.

Figure 1.6.1 Number of Suicides 1999-2016 by Year and Race



In Figure 1.6.2, the number of suicides was divided by the population for each race for that year to gain a better understanding of race and suicide. This graph shows that the White Race has the highest proportion of suicides, with the American Indian or Alaska Native race taking a close second. Additionally, the proportion of White suicide is steadily increasing, while the other races have more unpredictable patterns in regards to the proportion.

Figure 1.6.2 Crude Rate of Suicides 1999-2016 by Year and Race

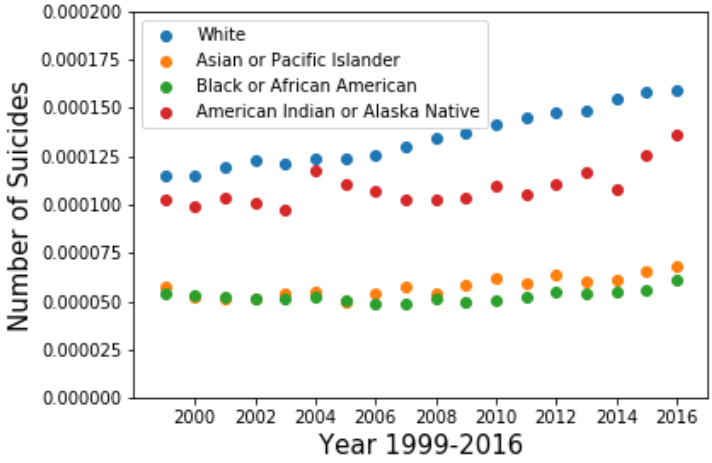
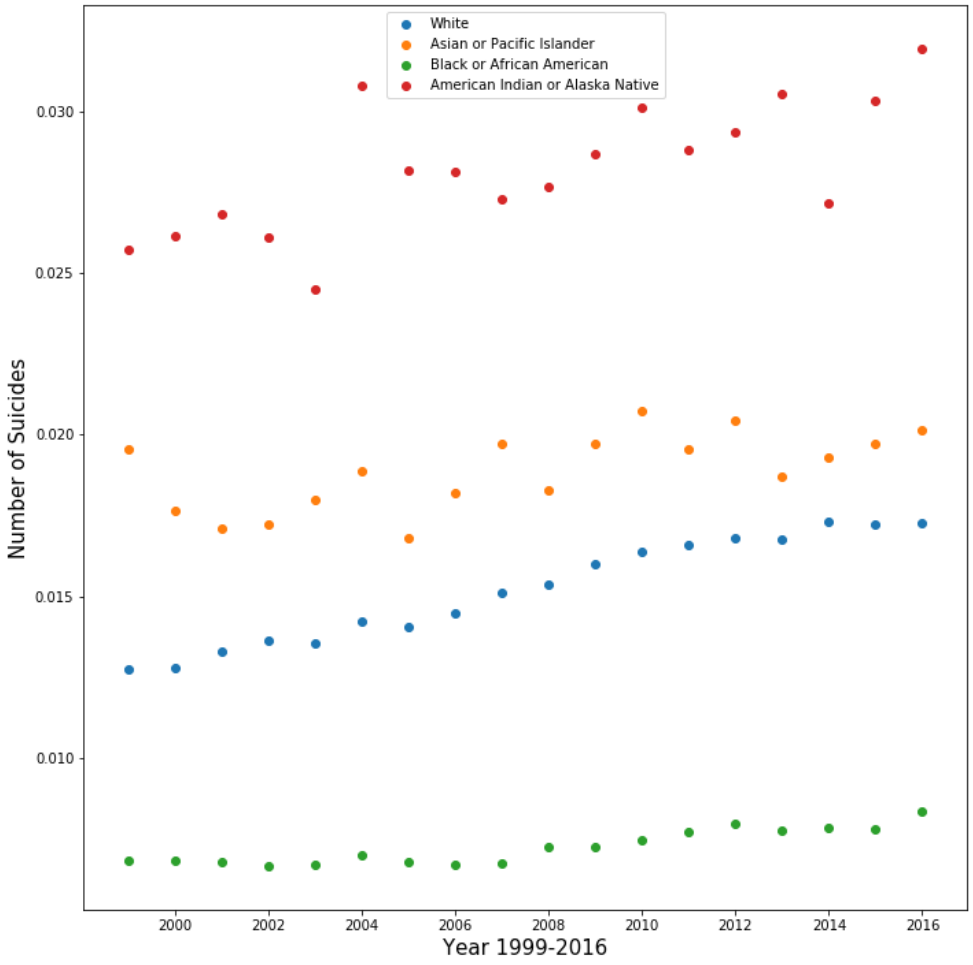


Figure 1.6.3 focuses on the proportion of deaths contributing to suicide for each race. This graph gives us a very different picture than the one above, with

the American Indian or Alaskan Native race having the highest proportion for the entire span of 17 years. In 2016, the American Indian or Alaskan Native race experienced an all time high of 31.92% of deaths having resulted from suicide. According to the National Action Alliance for Suicide Prevention's American Indian and Alaska Native (AI/AN) Task Force researchers, AI/AN people experience "more severe problems with anxiety, victimization, substance abuse, and depression" than other ethnicities, which contributes to their higher suicide rate (Wexler et al., 2015). Additionally the researchers emphasize the co-occurrence of suicidal behaviors and alcohol and drug use in the AI/AN community, citing that "more than half of the individuals who exhibited suicidal behavior were intoxicated at the time" (Wexler et al., 2019). Another study notes that high indigenous suicide rates are a major source of health inequity across all high-income countries, not only the United States (Pollock, Naicker, Loro, Mulay, & Colman, 2018). The next highest proportion occurs in the Asian or Pacific Islander race. Both races have an overall increase in their proportion, but with extreme fluctuations year to year. The White and Black or African American races follow, both with steady increases in their rates over the years. The fact that the Black or African American population has a lower percentage of suicides than Whites is considered paradoxical because "blacks experience much higher rates of morbidity, disability, and mortality than whites" (Rockett, Samora, Coben, 2006). One study suggests that this racial disparity may be due to the misclassification of suicides, with more Black or African American deaths being ruled as accidents, over Whites (Rockett, Samora, Coben, 2006).

Figure 1.6.3 Crude Rate of Suicides by Deaths 1999-2016 by Year and Race



Overall, White Americans have the highest number and percentage of individuals to commit suicide each year. Additionally, “American Indian or Alaska Native” or “Asian or Pacific Islander” has the highest proportion of their deaths attributed to suicide in the U.S.

Chapter 2: Combined Field Analysis

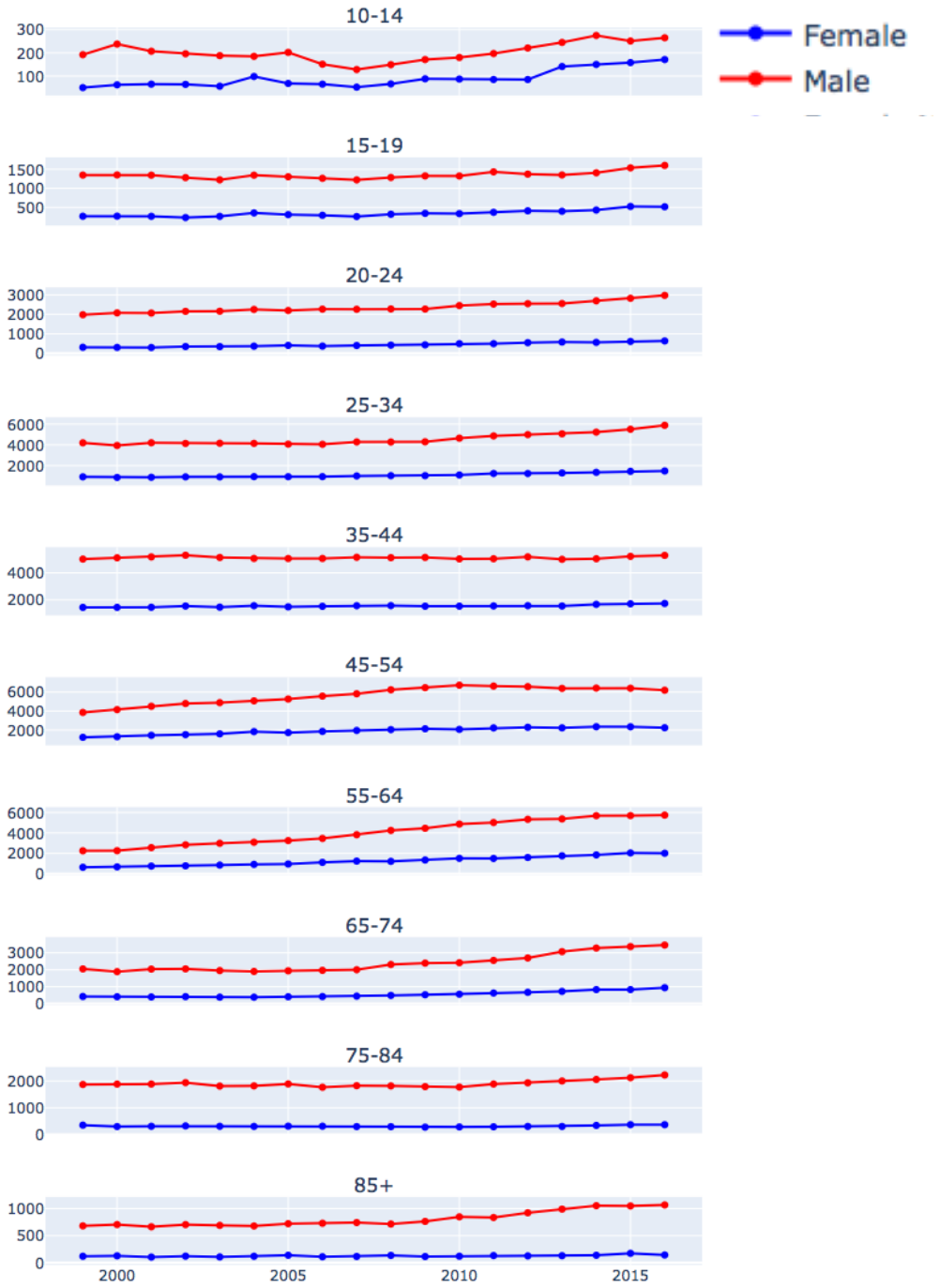
This chapter will explore the suicide death certificate data using multiple fields of information to create visualizations. Each section will consist of the same process described in Chapter 1, which is further noted in Appendix A Part 1. Each section will focus on the data downloaded from the CDC Wonder Database with the fields specified in the section header and the year. Every dataset has been checked to ensure the total number of suicides remains consistent for each year. Additionally, it is important to note that the combinations of fields are chosen intentionally, so that every category has the appropriate number of individuals. Per the CDC rules, any category of suicides that has less than 9 individuals represented cannot be published; therefore, reducing what is able to be represented below. Below, the plotly python library was used to create the graphs with subplots, allowing multiple categories to be represented at the same time. Each subplot has its own adjusted scale that allows for a better representation of the differences between the given categories.

Part 1: Gender and Age Group

The overall totals given for the number of suicides matches the previous sections, although the fields with the age groups: < 1 year, 1-4 years, 5-9 years, and Not Stated were excluded from the representations below.

For all the age groups listed below the number of male suicides greatly outnumbers the number of female suicides. For every age group and every year, excluding the age group 10-14 from 2013-2016, the number of female suicides has been less than half of the number of male suicides. The highest number of suicides for the categories included occurred in 2010 with 6,673 suicides by men between the ages of 45-54. Comparatively, the highest number of female suicides occurred in 2014 with 2,347 women between the ages of 45-54. Given that the highest number of suicides have been from the age group of 45-54 since 2004, as discussed in Chapter 1 Part 3, it is not surprising that the age group is also responsible for the highest number of male and female suicides.

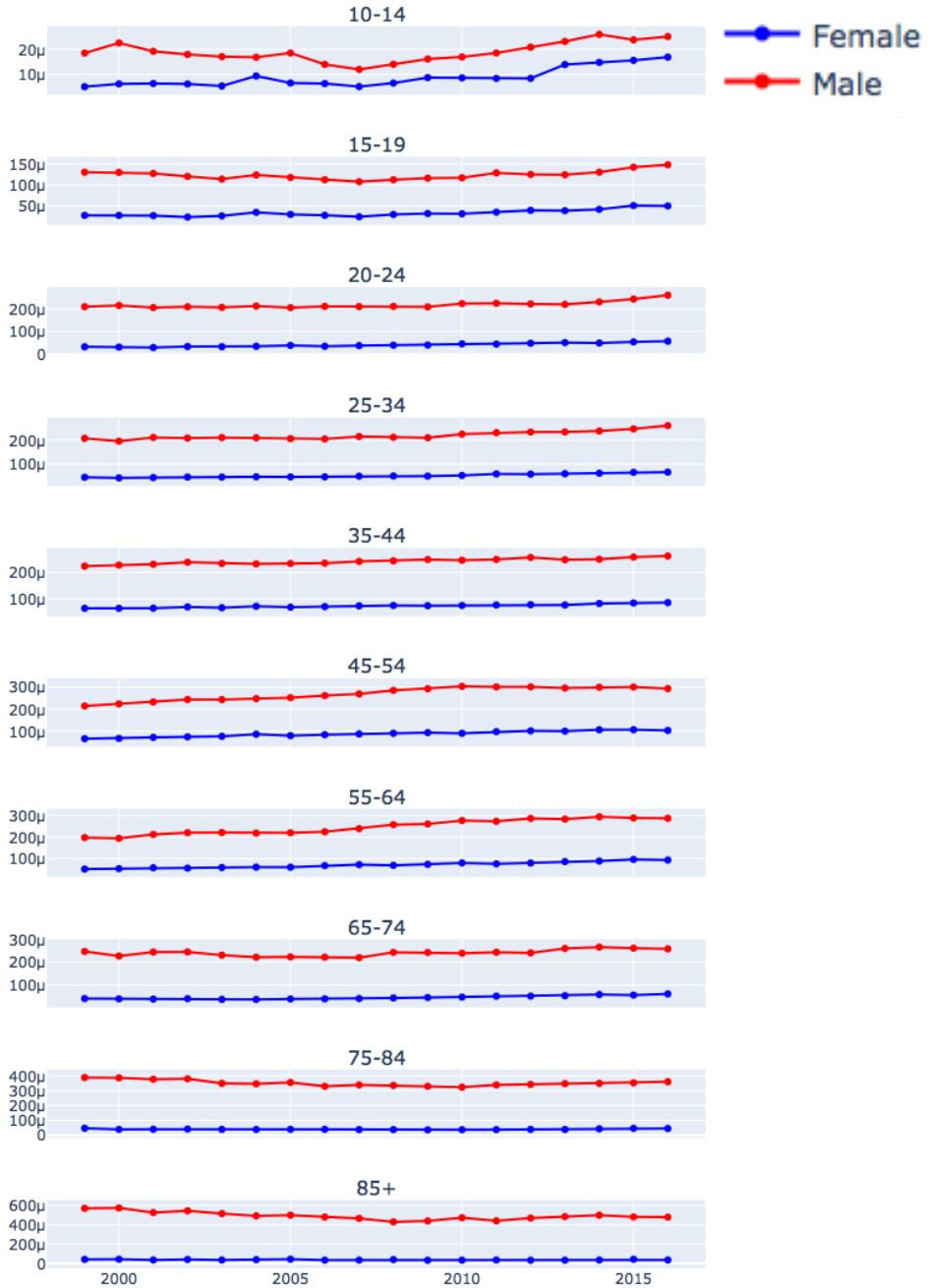
Figure 2.1.1 Number of Suicides By Gender and Age Group



For Figure 2.1.2, the percentage of suicides based off the total population for each category was graphed in the same way as the graph above. The highest percentage of suicides for the given categories occurred in 2000 with a

percentage of .0547% of males at age 85+. These results are slightly different than one may expect, given that the highest rate for age groups occurred in the age group of 45-54 as discussed in Chapter 1 Part 3. Comparatively, the highest rate for females occurred in 2015 with .0107% of women between the ages of 45-55. All categories below experienced increasing percentages, except for age groups 75-84 and 85+. The females of the age group 75-84 experienced consistent rates, while females 85+ and males 75-85+ experienced decreasing rates. In one study, Nikolaos Antonakakis and Rangan Gupta found correlation between the male suicide rates and increased economic policy uncertainty (2016).

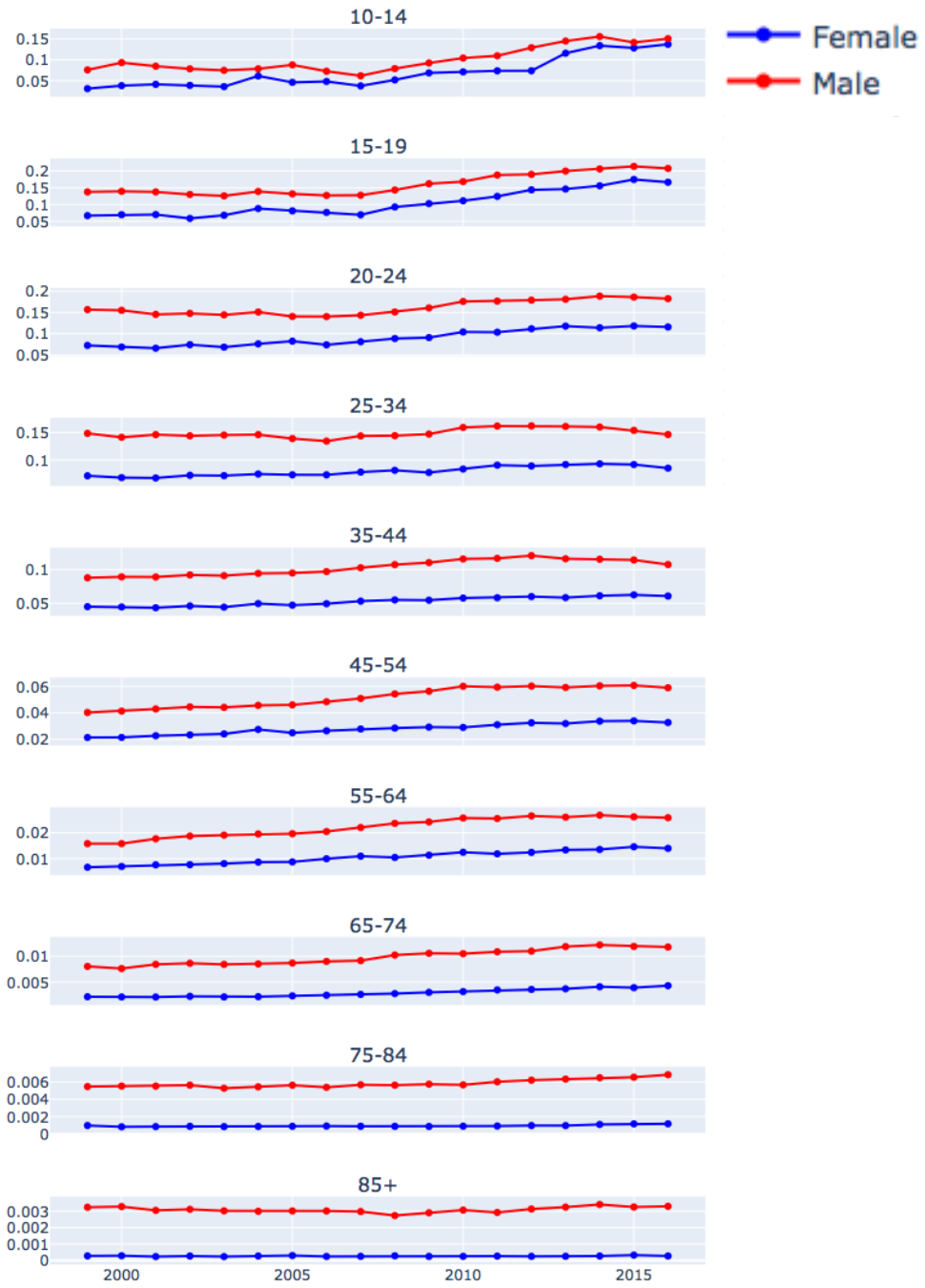
Figure 2.1.2 Percentage of Suicides of the Population By Gender and Age Group



In Figure 2.1.3, the percentage was determined by the number of suicides divided by the total number of deaths for each category represented below. This graph shows that in the age group 10-14 in 2015 only had a 1.319% difference between the male and female percentage of deaths by suicide. For several

years, the age group 10-14 shows little difference between the two genders. In 2015, 21.39% of male deaths between the ages of 15-19 were due to suicide, making it the highest percentage of any given category. Additionally, the age groups 10-14 and 15-19 have a noticeable increasing trend, and with already high percentages in these two age groups, it is a cause for concern. One Harvard Associate Medical Researcher attributes these high suicide rates amongst young people to “high rates of depression and anxiety, unprecedented levels of social media use, a greater willingness of families and officials to acknowledge suicide as a cause of death”, and later goes on to discuss the opioid crisis as a contributing factor (Healstaff, 2019). San Diego State University psychologist, Jean Twenge, adds that youth suicides do not align with expected factors, such as public traumas, and the new generations’ relationships with technology is a key factor in the ever increasing suicide rates (Healstaff 2019).

Figure 2.1.3 Percentage of Suicides of Deaths By Gender and Age Group

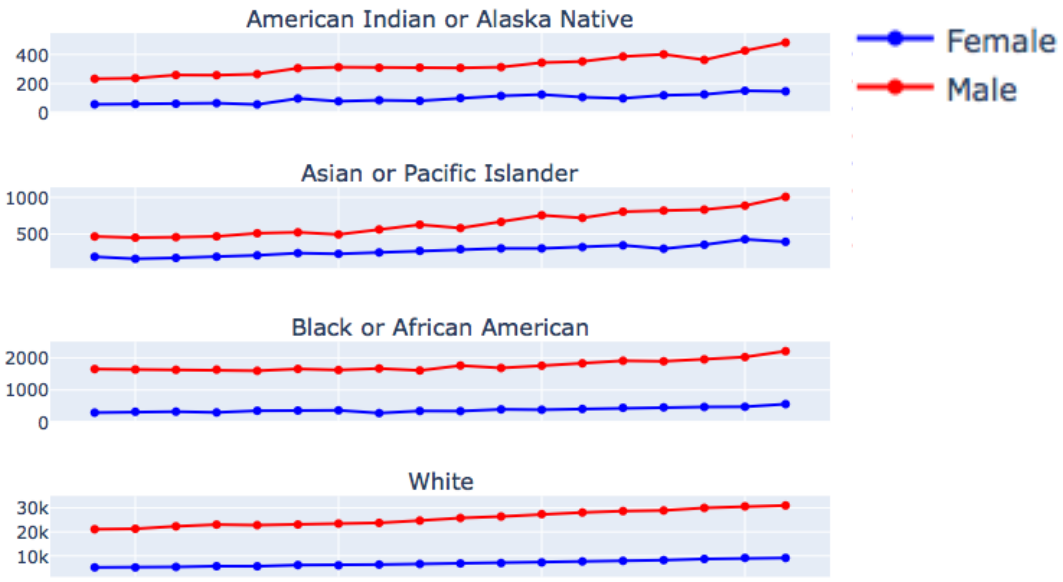


Part 2: Gender and Race

In Figure 2.2.1, the number of suicides for each gender and race is visualized. Similarly to the above section, the number of male suicides is much

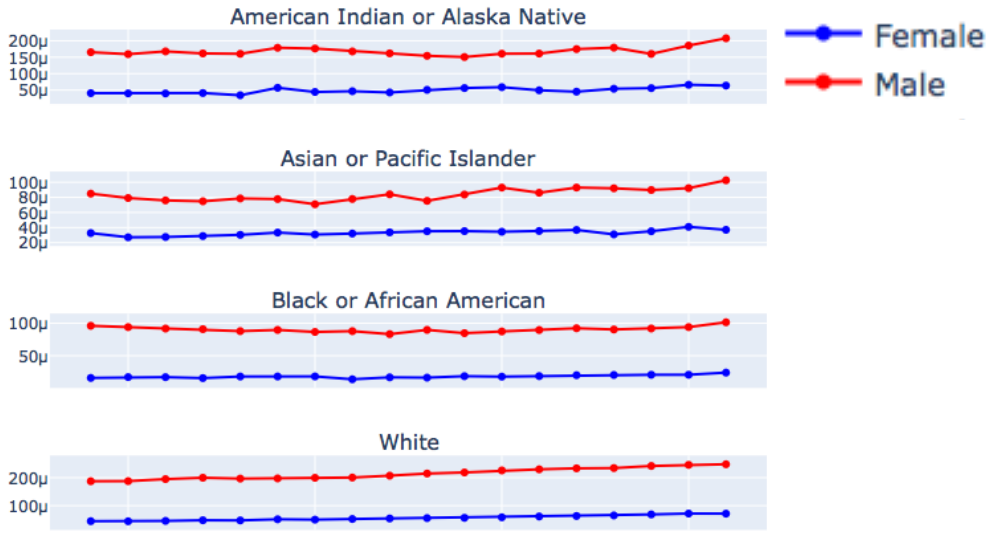
higher for each race and year. As expected, due to the information gathered in Chapter 1 Part 6 on race, the highest number of suicides for males and females occurs in the white race.

Figure 2.2.1 Number of Suicide by Gender and Race per Year



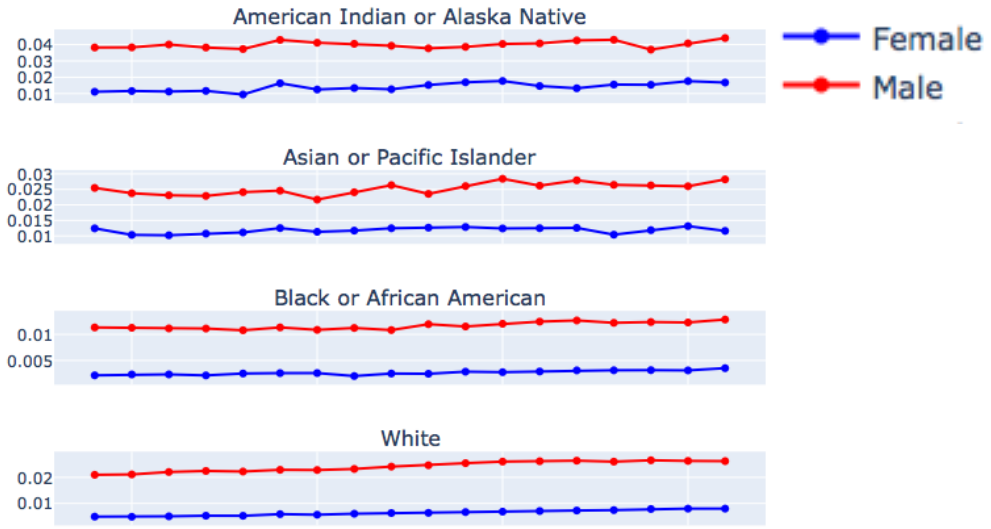
Due to the high population of whites, a better measurement to examine the data would be to use the percentage of suicides for the given population. This measurement, shown in Figure 2.2.2, also shows the highest percentage for males and females in the “White” race, with the “American Indian or Alaska Native” race taking a close second.

Figure 2.2.2 Percentage of Suicide by Population by Gender and Race per Year



In Figure 2.2.3, the percentage of suicides by deaths is determined by the number of suicides divided by the total number of deaths for each category and year listed. This representation shows that the highest percentage of any category belongs to the American Indian or Alaska Natives with males in 2016, having 4.404% of deaths being ruled suicides. This percentage of American Indian or Alaska Natives Males is nearly double the highest percentage for white males. The next highest percentages are given by Asian or Pacific Islander, leaving White as the third highest for the males. This ranking of percentages also applies to females. Between the above and below graph, it can be concluded that for both genders, Whites have the highest percentage of the population die by suicide, whereas American Indians or Alaskan Natives have the highest percentage of suicide for the total number of deaths.

Figure 2.2.3 Percentage of Suicides of Deaths by Gender and Race per Year

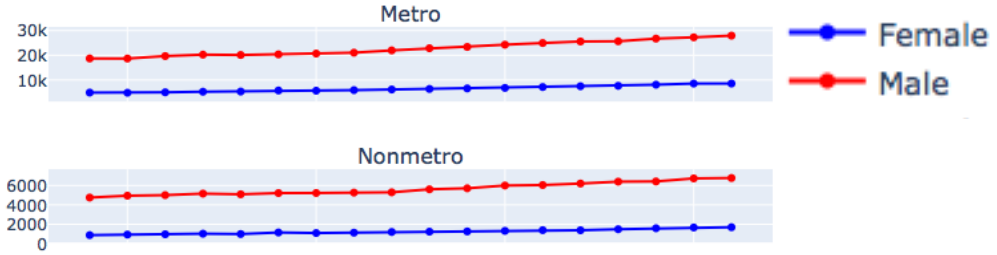


Part 3: Gender and Metro/Nonmetro

For further explanation regarding the definition of the 2013 Metro/ Nonmetro categorization, please refer to Chapter 1 Part 5 above.

In Figure 2.3.1, the number of suicides for each gender and metro category is graphed below. As suspected, the number of female suicides for both categories is much lower than the number of male suicides. Additionally, the number of suicides has been increasing each year for all four categories below.

Figure 2.3.1 Number of Suicides by Gender and Metro/Nonmetro per Year

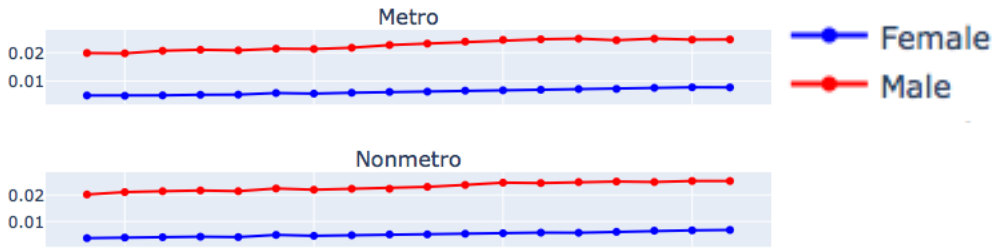


In Figure 2.3.2, the same four categories are graphed, divided by the overall population of each category, for that year. The highest percentage of suicides for the given populations occurred in 2016 with nonmetro males having .0293% commit suicide. The metro male category had a similar high in 2016 with .0206% commit suicide. The all-time high for females also occurred in 2016 with much lower percentages of .00738% for nonmetro females, and .00606% for metro females. Both categories had higher percentages of nonmetro suicides than metro suicides for both genders for each year.

Figure 2.3.2 Percentage of Suicides by Population of Gender and Metro/Nonmetro per Year

In the Figure 2.3.3, the same categories are used to visualize the percentage that suicides contribute to the overall total of deaths per year for each category. Using this measurement, the percentage of metro female suicides by the number of deaths was higher for every year over nonmetro females. Conversely, the nonmetro males had a higher percentage for every year excluding, 2009, 2011, 2012, and 2014, over metro males.

Figure 2.3.3 Percentage of Suicides by Total Deaths of Gender and Metro/Nonmetro per Year



Part 4: Race and Age Group

The overall totals given for the number of suicides matches the previous sections. Additionally, the fields with the age groups: < 1 year, 1-4 years, 5-9 years, and Not Stated were excluded from the representations below due to the CDC restrictions on the presentation of data.

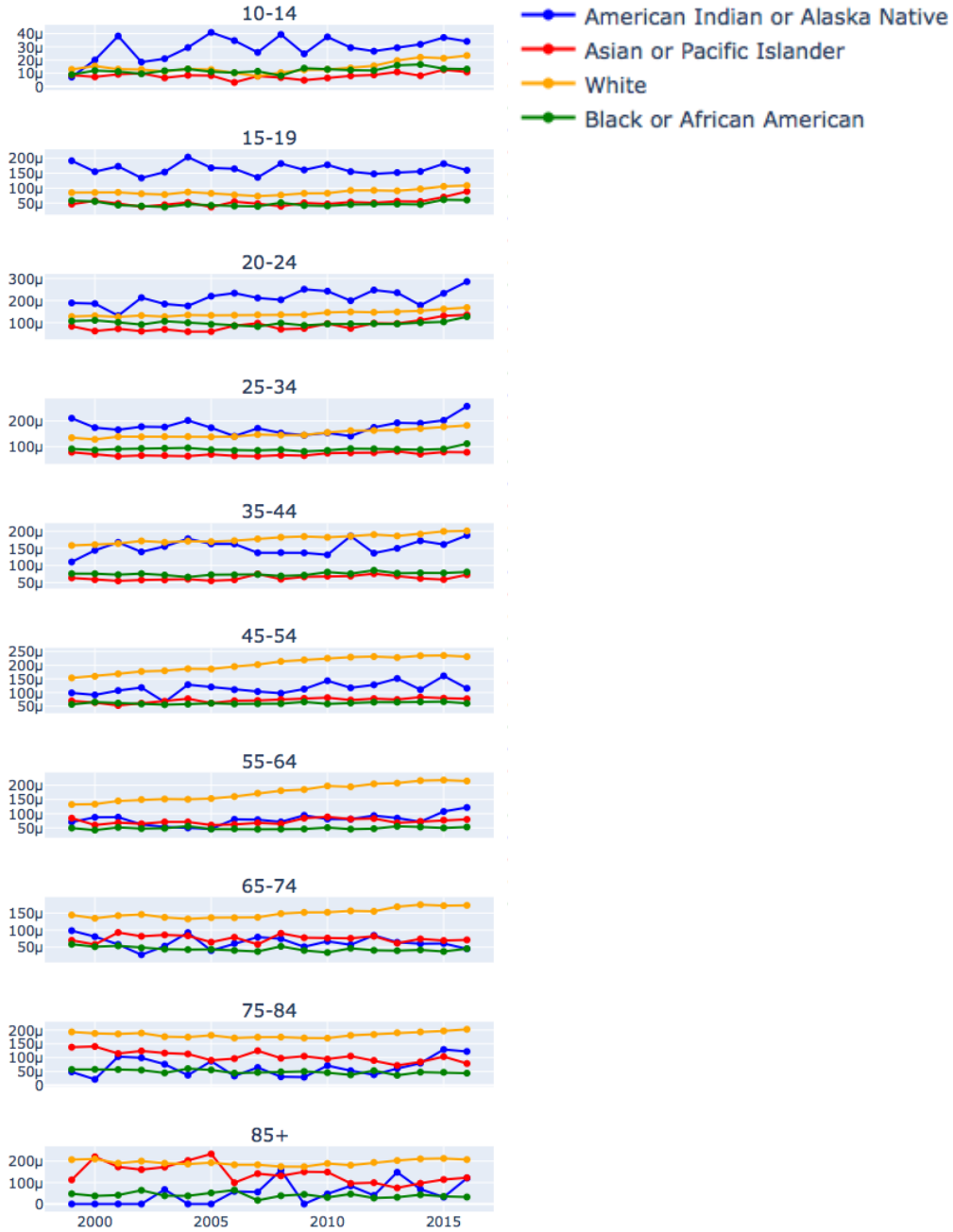
In Figure 2.4.1 the total number of suicides for race and age group is graphed by year. From the graph, it can be determined that the highest number of suicides is contributed by Whites for all age groups. Due to the vast difference in the overall number of suicides, any other information is difficult to be gleaned from this graph.

Figure 2.4.1 Number of Suicides by Age Group and Race per Year

In Figure 2.4.2, the number of suicides was divided by the total population for each category. Using this measurement, it can be determined that whites contribute the highest percentage of suicide based on population for the ages of

35-84. For the ages of 10-34, American Indian or Alaskan Natives contribute the highest percentage of suicide for their population. The highest percentage occurred in 2016 with 0.0286% of the American Indian or Alaskan Native 20-24 year olds committing suicide that year. For the 85+ category, the highest percentage of individuals to commit suicide is between the White and the Asian or Pacific Islander race.

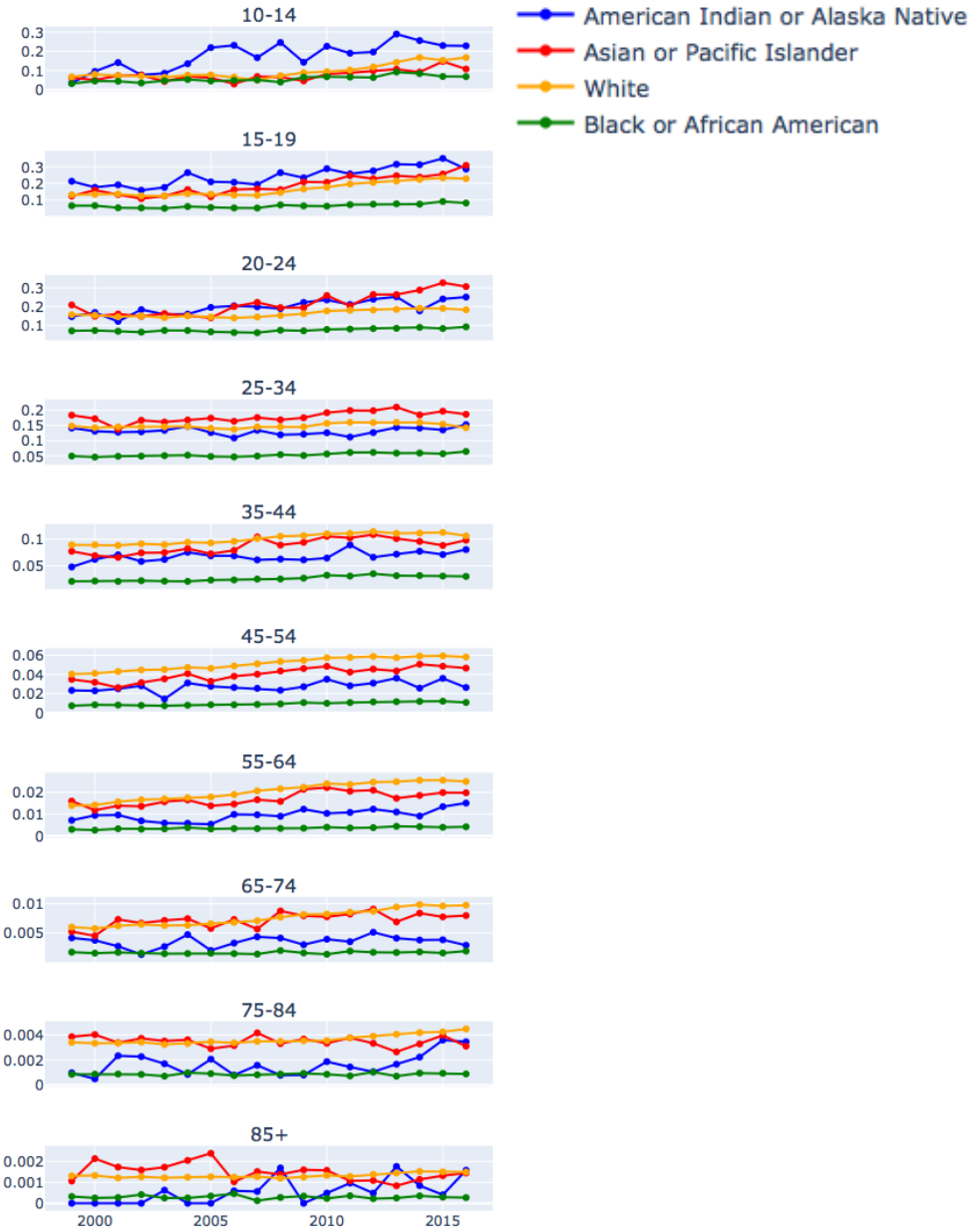
Figure 2.4.2 Percentage of Suicides by Population of Age Group and Race per Year



In the Figure 2.4.3, the total number of suicides was divided by the total number of deaths. For ages 10-15, the American Indian or Alaskan Native population has had the highest percentages of death attributed to suicide. For ages 20-24, the American Indian or Alaskan Native and the Asian or Pacific

Islander population have contributed the most. For the age group of 25-85+ both the White and Asian or Pacific Islander population have had the highest percentages. The all time high percentage occurred in 2015 with the AI/AN population of 15-19 having 35.23% of the deaths attributed to suicide.

Figure 2.4.3 Percentage of Suicides by Deaths of Age Group and Race per Year

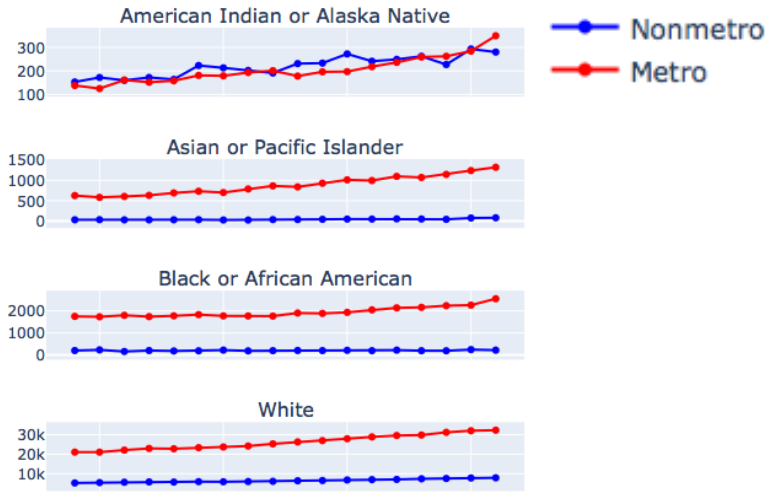


Part 5: Race and Metro/Nonmetro

For further explanation regarding the definition of the 2013 Metro/ Nonmetro categorization, please refer to Chapter 1 Part 5 above.

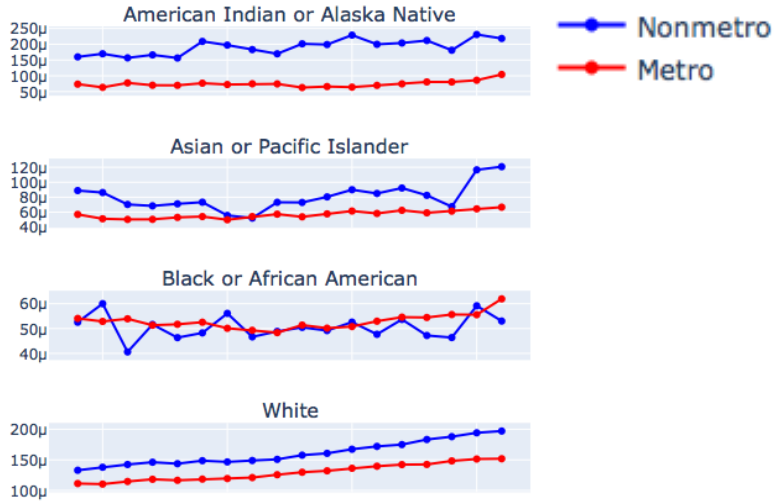
In the following graph the total number of suicides is shown for each population, showing a higher number of Metro suicides every year for all races but the American Indian or Alaska Native.

Figure 2.5.1 Number of Suicides by Race and Metro/Nonmetro per Year



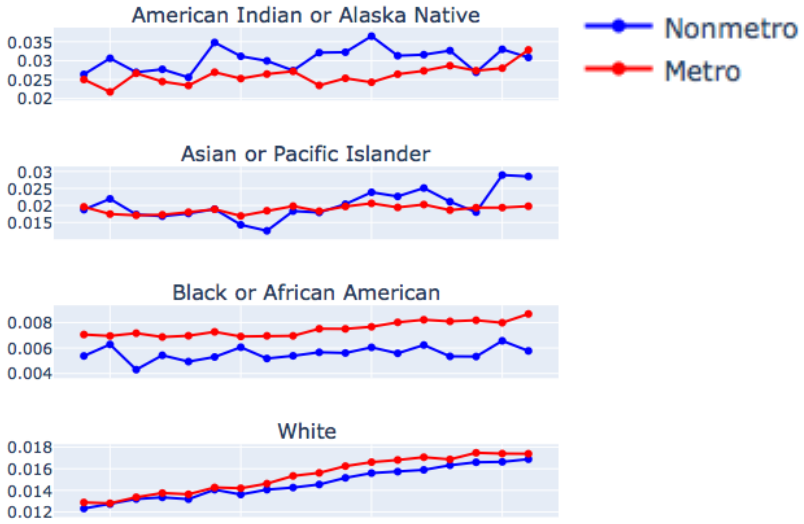
Due to the population differences between metro and nonmetro areas, the Figure 2.5.2 tracks the overall percentage of suicides based on the total population of the given category. For all races, except for Black or African American, there is a higher percentage of nonmetro suicides over metro suicides. For the Black or African American Race, there is no consistent trend with the percentage between metro and nonmetro. The all time high percentage occurred in 2015 with .0231% of the American Indian or Alaska Native population.

Figure 2.5.2 Percentage of Suicides by Population by Race and Metro/Nonmetro per Year



In Figure 2.5.3, the value graphed represents the percentage of deaths that were suicides for each population. This graph shows even more varied trends with the American Indian or Alaska Native population being the only population with a higher percentage of nonmetro deaths by suicide. Additionally, the Asian or Pacific Islander population has an inconsistent trend between the metro and nonmetro suicides.

Figure 2.5.3 Percentage of Suicides by Deaths by Race and Metro/Nonmetro per Year

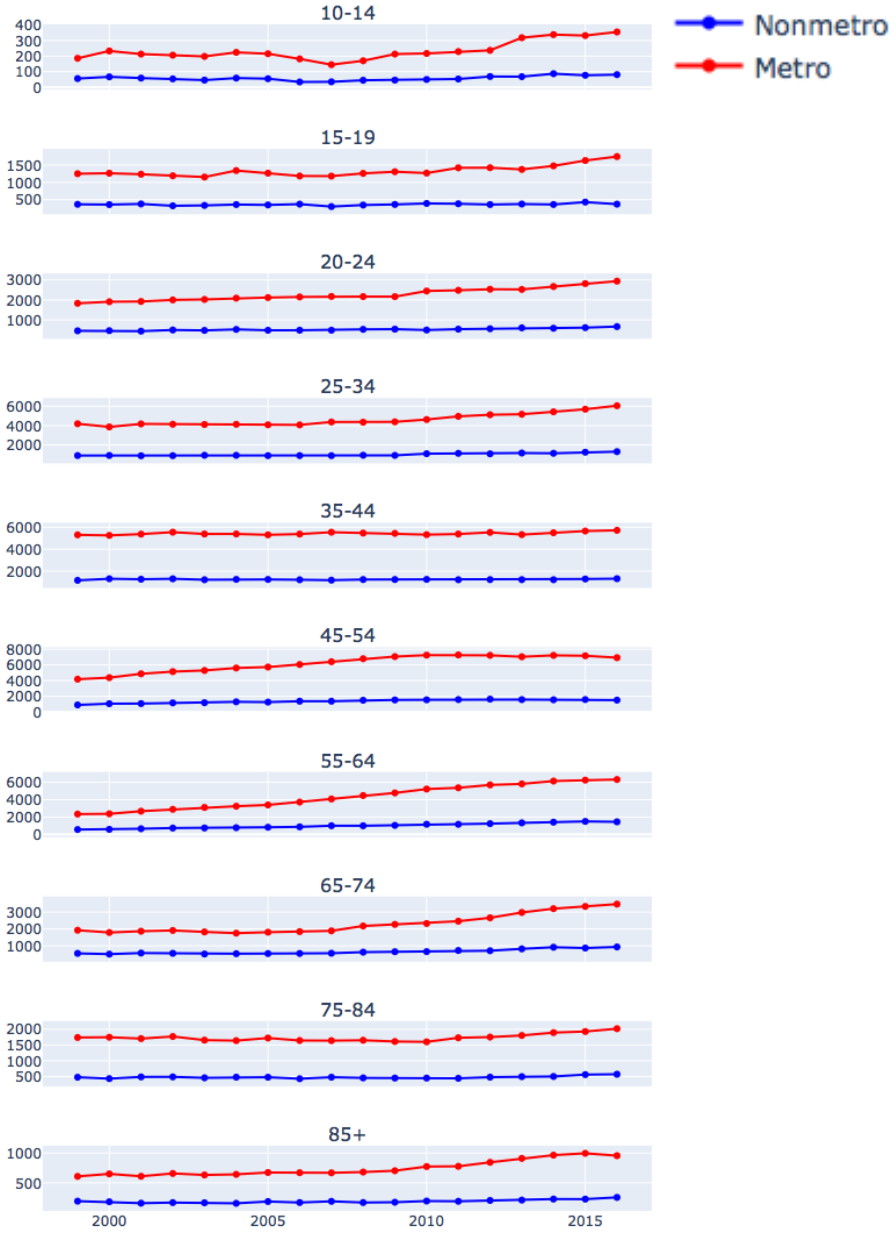


Part 6: Age Group and Metro/Nonmetro

For further explanation regarding the definition of the 2013 Metro/ Nonmetro categorization, please refer to Chapter 1 Part 5 above. Additionally, the fields with the age groups: < 1 year, 1-4 years, 5-9 years, and Not Stated were excluded from the representations below.

In Figure 2.6.1, the total number of suicides for each category of metro/ nonmetro and the corresponding age group have been graphed. Given the higher population in metro areas, it is unsurprising that the highest number of deaths for every age group falls within the metro category.

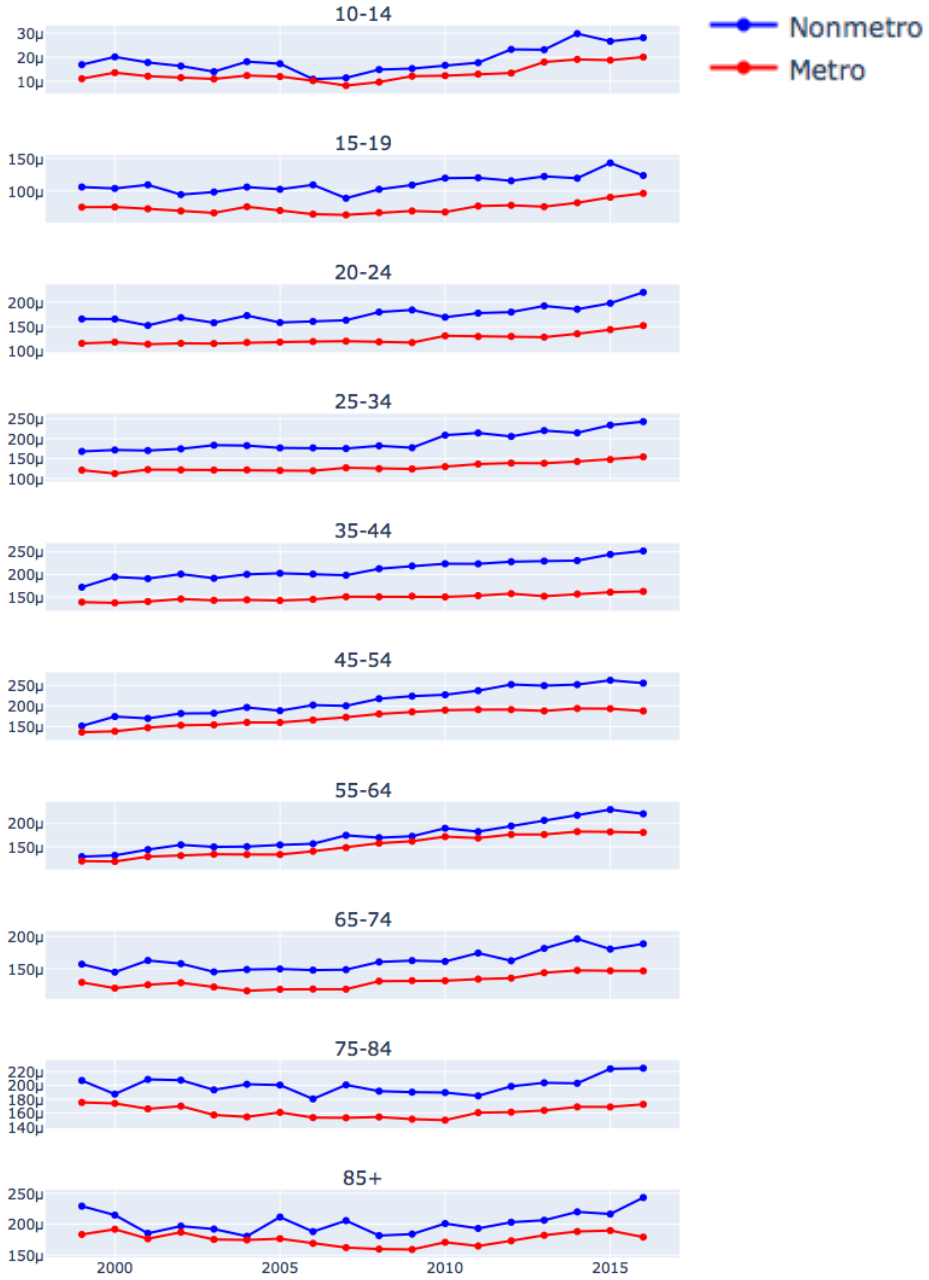
Figure 2.6.1 Number of Suicides by Age Group and Metro/ Nonmetro per Year



In Figure 2.6.2, the percentage of each population is determined by taking the total number of suicides and dividing it by the corresponding population. Using this measurement, it can be shown that for every age group, the highest percentage of suicides occurs in nonmetro areas. The highest percentage

occurred in 2016 with .02433% of nonmetro 85+ year olds committing suicide that year.

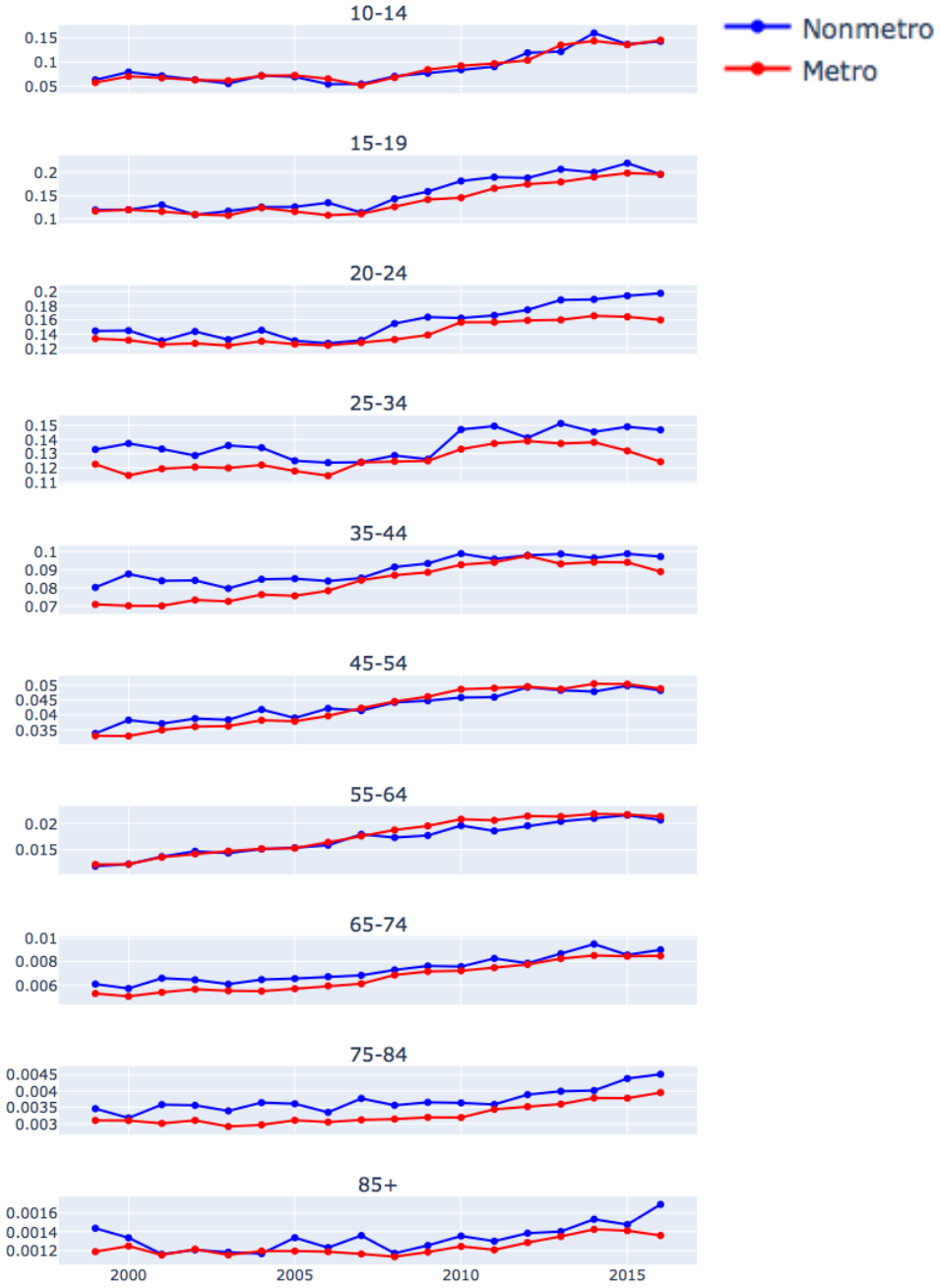
Figure 2.6.2 Percentage of Suicides by Population by Age Group and Metro/Nonmetro per Year



In Figure 2.6.3, the percentages graphed were determined by taking the total number of suicides and dividing them by the total number of deaths for that

population. Using this representation, the percentages of metro and nonmetro are much closer. Given that Figure 1.5.3 had shown a similar trend for the percentage of suicides for the overall population, it is unsurprising that the trend would stay consistent amongst various age groups.

Figure 2.6.3 Percentage of Suicides by Death by Age Group and Metro/Nonmetro per Year



Part 7: Conclusion

Overall, the total number, percentage of the population, and the percentage of deaths caused by suicides have increased over the time period of 1999-2016. Additionally, for every category examined, males have had a higher number, percentage of the population, and percentage of deaths attributed to suicides over females. As time has progressed, the female population has had a faster increase in overall numbers and rates comparative to males, creating the potential for similar numbers and rates in the future. It is also important to note that this gender disparity is not a reflection of male versus female mental health, rather only a reflection of successfully committed suicides.

For the varying age groups, the 45-54 age group has had the highest percentage of suicides, whereas teenagers and pre-teens have had the highest percentage of deaths attributed to suicides. For the 10-14 age group, the percentage of suicides in the Native American and Alaskan Native group is especially high. Given the increasing percentage of suicides by young people, psychologists have investigated the reasoning behind these suicides and have cited high rates of depression and anxiety, social media use, a greater willingness to acknowledge suicide as a cause of death, and the opioid crisis as a contributing factors. The age groups 75-84 and 85+ are the only age groups whose rates have not increased.

Utilizing the ICD Chapter/Cause of Death, the most common cause of death for suicides has been firearm and explosive use for the time period of 1999-2016, with suffocation coming second. These two causes of death are

considered the most deadly, meaning that suicides attempted by these methods are most likely to result in a successful suicide. Legislation that has been attempted to curb suicides by firearms, have not decreased suicides, but rather increased the rate of suffocations.

Nonmetro counties have a higher percentage of suicides for every population, although the percentages deaths for nonmetro and metro suicides is relatively similar. For the category of races, the White race has the highest percentage of suicides for the overall population, while the Native American and Alaskan Native population have a higher percentage of deaths attributed to suicides. High rates of indigenous people suicides is not exclusive to the United States, but a common occurrence amongst all first world countries.

When combining categories, the trends for the individual fields tend to remain the same. Using the analysis and visualization provided, future psychologist and medical professionals can identify and help individuals at a higher risk for suicide.

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Appendix A

Part 1: The Process

1. **Downloading the CSV File:** In order to download the csv file, the first step is to agree to the waiver on the CDC Wonder Portal. This waiver lists the restrictions that one must agree to in order to utilize the information provided by the CDC. After agreeing to the CDC Portal restrictions, the user is redirected to the request form. There fields can be specified in order to download the desired information to a csv file. In Chapters 2 and 3, the exact specifications made for each desired result will be explained. Additionally another csv file had to be downloaded from the CDC to gather the total number of deaths for that year and corresponding population.
2. **Cleaning the CSV File:** After downloading the CSV file, the file needs to be further edited in order to produce the proper file formatting for Python analysis. In order to complete this task efficiently, a shell script was used to clean up each file of extra spaces, commas, and periods. Additionally a shell scripts were used to combine data for the overall total number of deaths for each population with the suicide and population information.
3. **Python Scripts:** In order to produce graphs and statistical analysis of the data, Python scripts were used.